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Phelps' Water-Level Indicator and Automatic Gauge Cleaner.

We illustrate herewith a device which is so simple, and at the same time so obviously useful, that the wonder is that it was not thought of sooner.

All engineers are familiar with the difficulties attending the use of the ordinary water glass gauge. If the water is very clean and clear there is not sufficient difference in color and appearance between that part of the glass which is filled with water and the part above the water line to make the line easily and quickly discernible, especially if the light is insufficient, or if it falls upon the glass from an unfavorable direction.

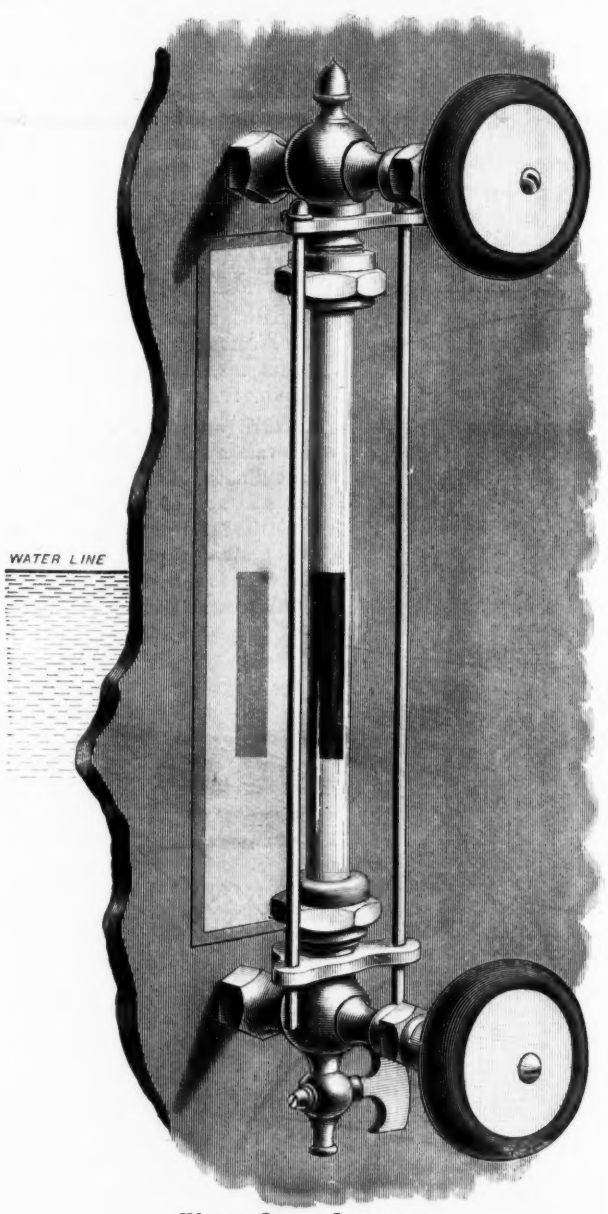
If, on the other hand, the water is dirty, every time the water line remains for some time at the same point the scum, which is upon the surface, deposits rings in the glass which are easily mistaken for the water line. These rings are deposited one after the other until the glass is coated to such an extent as to make it impossible to see the water. Then it must be taken out and cleaned, when, for some as yet unexplained reason, it usually breaks.

The float seen inside the gla ... the engraving consists of a tube of oxydized silver, closed at each end, and its weight so made as that it will, when floating in water, project above the surface about $\frac{1}{32}$ of an inch. It is about $2\frac{1}{2}$ inches in length, and, being oxydized, is so black as to be easily seen, even where the conditions as to light, position, and so on, are the least favorable, thus rendering mistakes in locating the water line much less liable to occur, and making the management of steam boilers to that extent less dangerous.

When it came to putting this device into practical use, it was found that another effect of the float was, by its constant motion within the glass, to keep it absolutely clean, thus not only giving the advantage of a clean glass, but avoiding the necessity of removing them for cleaning, and the consequent breakage of glasses. Back of the glass is placed a white enameled metallic plate, which forms a contrast with the black float and a surface upon which the shadow of the float may be easily seen, thus making the water level easily discernible from any part of the boiler room. The importance of any device which will certainly lessen the risk attending the use of steam plants will readily be recognized by those who are familiar with such matters, and when with such a device great simplicity and low cost is secured, as in this case, it is very apt to commend itself to boiler owners and engineers.

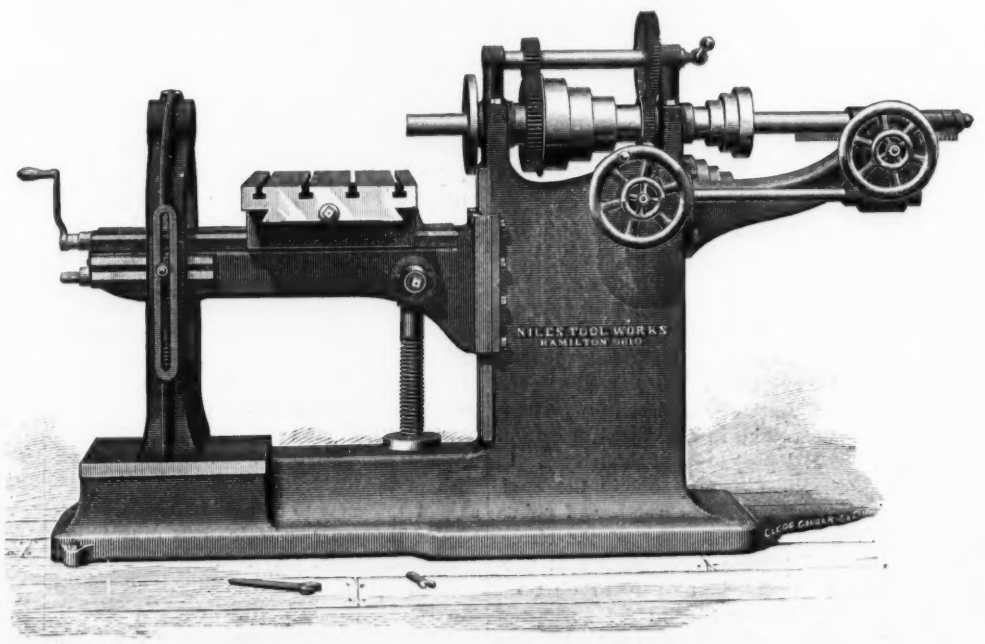
The indicator has been tested by some of the leading engineers in New York and has met with their approval, and after a five months' trial, the Board of Examining Engineers of the U. S. Navy recommended its adoption, and it has accordingly been adopted for use in the navy.

It is being introduced by the Ashcroft Manufacturing Company, of New York City.



WATER LEVEL INDICATOR.

"It's an ill wind that blows nobody good," and the Government is now deriving a considerable income from inventors and patentees of bustles, and, strange to say, the originators of these bustles are now, as they always have been, men.



HORIZONTAL BORING AND DRILLING MACHINE.

No. 1 Horizontal Boring and Drilling Machine.

This machine has been designed to meet the wants of the trade for a tool of medium size, but still of ample power and strength to do good work rapidly.

The boring spindle is of steel $2\frac{1}{2}$" diameter and has 17 inches traverse. This, together with the traverse of the table, enables the machine to bore a hole 36 inches long. The spindle has rapid hand movement by rack and pinion. The driving cone has four speeds for $2\frac{1}{2}$ inch belt, and is back geared. Rates in back gear seven to one.

The feeds are operated by belt with four changes. The main table is three feet nine inches long, and supports a saddle and cross-table, the latter 19 inches by 40 inches. The logitudinal traverse of cross-table is 20 inches; transverse traverse of cross-table 26 inches.

The outer end of the boring bar is supported by an adjustable yoke, which also affords additional support for the table. It can be removed when desired.

All sliding surfaces are accurately fitted by scraping. The countershaft pulleys are 16" diameter; $3\frac{1}{2}$" face. Speed 96 revolutions. The machine will bore to the center of a 48 inch circle. It is built by the Niles Tool Works, Hamilton, Ohio.

There is a notable falling off in the number of patents issued for car couplers, but car-heating devices seem likely to fully supply the deficiency.

There seems to be no limit beyond which the bridging of large navigable rivers will not yet be carried. The latest plan, which, however, has not yet taken practicable shape, is to bridge the Hudson river at New York.

Admiral Porter advocates the building of merchant vessels that could be used in the navy in case occasion made it advisable. But he fails to show what inducements anyone has to build such vessels, which is rather an important omission.

An English inventor has brought out a lock for theater doors which is so constructed as to offer no resistance to egress, but to effectually prevent ingress except by using the key. This is for service in case the doors are locked for any reason, but exactly why they should be locked when the house is filled, is not clear. But as some theaters in London have been fitted with these locks, it is probable that they do things differently there from what we are accustomed to in this country.

According to our foreign exchanges, the experiments that have been made on Prussian railways with axle boxes in which parchment is used instead of brass, have been successful. The parchment, as it is called, appears to be highly compressed paper, and this, it is said, becomes impregnated with the lubricant so as to run a long time without attention.

Practical Drawing.

By J. G. A. Meyer.

FORTIETH PAPER.

375. Remarks relating to Problem 51: It may often appear difficult to find the projections of straight lines, and more so to find the projections of curved lines; but if we remember that, when we have the projections of two points of a given straight line, its projection is known; and when we have the projections of several points of a given curve, the projection of the curve is also known; consequently, we see that many problems can be reduced to very simple ones, in which all difficulties will disappear. Therefore we should be very particular to understand thoroughly the method of finding the projections of points in whatever position these may be given, or in whatever curve they may lie. It is the great importance of this subject which leads us to make the following remarks, thereby trusting to enable the student to become as familiar as possible with this subject.

In Fig. 268 it will be seen that in order to obtain the horizontal projection of the bases we first established a number of points, as f, h, etc., all equal distances apart in the vertical projection of the upper base of the cylinder. In relation to these points, it must be said that it is not necessary to make the distances between these points equal to each other; we did so simply to make the figure appear symmetrically; neither is it necessary that two points, for instance, such as e_2 and f_2, should lie in one straight line, drawn perpendicular to the upper base $m\ n$ of the cylinder; we simply adopted this method to save labor. We will obtain the same curve in the horizontal projection by taking any number of points (the more the better) in any position whatever in the circumference of the circle $m_2\ n_2\ c_2\ d_2$; thus: Fig. 269, let $A\ B$ be the ground line, and let $m\ n$ represent the vertical projection of the upper base of a cylinder having the same diameter, and the same inclination to the horizontal plane of projection as that represented by $m\ n$ in Fig. 268, and let the circle $m_2\ n_2\ c_2\ d_2$ in Fig. 269 represent the same base when its projecting plane coincides with the vertical plane of projection. For reasons given in Problem 51, the center c_4 of this circle will lie in a straight line drawn perpendicular to the line $m\ n$, and drawn through the point c midway between the extremities m and n. Now let us take any point as e_2 in the circumference $m_2\ n_2\ c_2\ d_2$, and find its horizontal projection. Our first step will be to find the position of the same point on the line $m\ n$, or in other words, find the position of the point e_2 after the plane which contains the same has been revolved about its trace $m\ n$ until it stands perpendicular to the vertical plane of projection. Now, in revolving this plane about its axis, which is the trace $m\ n$, the path of the point e_2 will be represented by a straight line $e_2\ e$ drawn through e_2 perpendicular to $m\ n$, and therefore the point e in which the line cuts the line $m\ n$, is the point sought. From the foregoing we see that the points e and e_2 represent one and the same point in space; the former is the position of the point when the projecting plane stands perpendicular to the vertical plane of projection, and the latter is the position of the point when the projecting plane coincides with the vertical plane of projection. Our next step will be to find the horizontal projection of this point. Let us consider the point e to be the vertical projection of a given point in space; we know, according to Article 227, that both the vertical and horizontal projection of a point must lie in a straight line drawn perpendicular to the ground line $A\ B$; we therefore draw a vertical line through the point e, and this line will contain the horizontal projection e_3 of the given point. It now only remains to find the distance between the point e_2 and the ground line $A\ B$. Since e_2 represents the given point when its projecting plane coincides with the vertical plane of projection, and since the projecting plane is turned around its trace, it follows that when the projecting plane stands perpendicular to the vertical plane of projection, then the distance between the vertical plane of projection and the point will be equal to that between the points e and e_2. We therefore lay off on the line $e\ e_3$ from the point e_4, in which it cuts the line $A\ B$, a point e_3, the distance between the points e_4 and e_3 being equal to that between the points e and e_2. Then will the point e_3 be the horizontal and the point e the vertical projection of a given point in space, and this same point is also represented by e_2. But since e_2 lies in the circumference of the circle, the point e_3 will also be a point in the boundary line of the horizontal projection of this circle. In a similar manner we may obtain the horizontal projections of any number of points chosen in the circumference of the circle, and then by joining these horizontal projections by a curved line we will obtain a boundary line of the base in the horizontal projection precisely the same as that shown in Fig. 268. Once more, in working drawings the ground line $A\ B$ is not drawn, and therefore, instead of laying off the point e_3 from $A\ B$, or in other words, measuring its distance from the ground line, we first draw the diameter $m_3\ n_3$, which is the horizontal projection of a diameter parallel to the vertical plane of projection, and from the point f_5 in which the vertical $e\ f_5$ cuts $m_3\ n_3$, we lay off on the line $e\ f_5$ the point e_3; the distance between these points must, of course, be equal to that between the points e_2 and f_4; the point f_4 being the point in which the line $e\ e_2$ produced, cuts the diameter $m_2\ n_2$ drawn parallel to $m\ n$. The result will be the same as before.

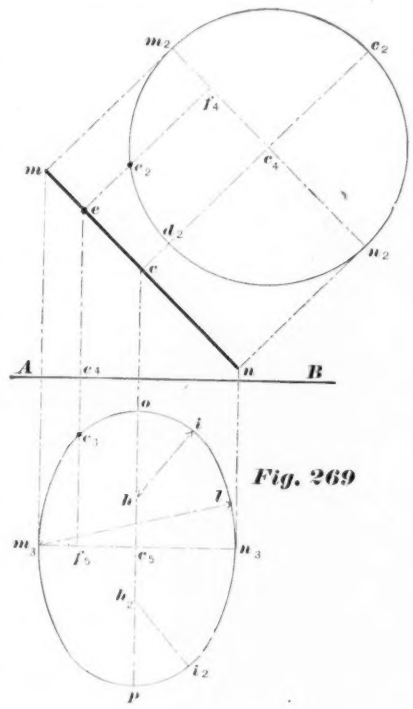


Fig. 269

376. When a right cylinder with a circular base is standing in an oblique position, as shown in Fig. 268, the horizontal projection of each base will be an ellipse. The center line $c_3\ d_3$ (Fig. 268), which is the longest straight line that can be drawn in the ellipse, is called the major axis; and the center line $m_3\ n_3$ (Fig. 268), which is the shortest line that can be drawn in the ellipse, is called the minor axis. A more precise definition of these axes will be given when we consider the properties of an ellipse.

Problem 52.

PRACTICAL APPLICATION OF PROBLEM 51.

377. TO FIND THE VERTICAL AND HORIZONTAL PROJECTION OF A FLANGED CYLINDER, THE DIMENSIONS AND POSITION OF THE SAME BEING GIVEN.

In this problem it is required to make an elevation and a plan of a flanged cylinder whose dimensions are given in the illustration; the axis of the cylinder is parallel to the vertical plane of projection, and oblique to the horizontal plane of projection.

In order to refresh the student's memory, we will remark that by the term "vertical projection" is meant an elevation of an object, and by the term "horizontal projection" is meant a plan of the object (see Articles 215 and 222); and when we say—"the axis of the cylinder is to be parallel to the vertical plane of projection"—we simply mean that in drawing the elevation of the cylinder we must assume the axis of the same to be parallel to the surface of the paper on which it is drawn; and by the expression "oblique to the horizontal plane of projection"—we mean that in drawing the plan of the cylinder we must assume the axis of the same to be inclined to the surface of the paper on which it is drawn.

In problems of this kind we must always make first that view of an object in which the true lengths of all the lines can be seen, and therefore we commence with the vertical projection or elevation of the cylinder.

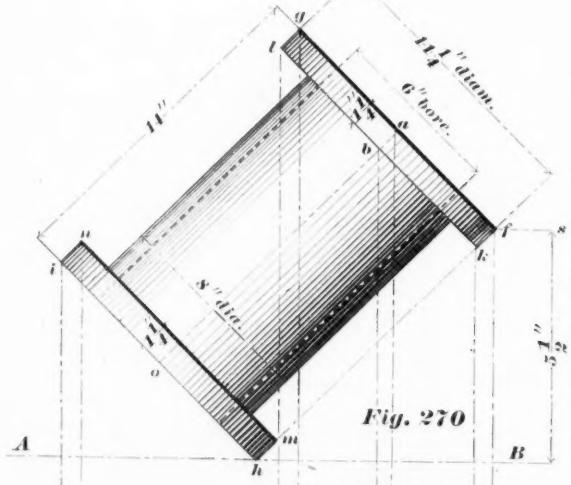


Fig. 270

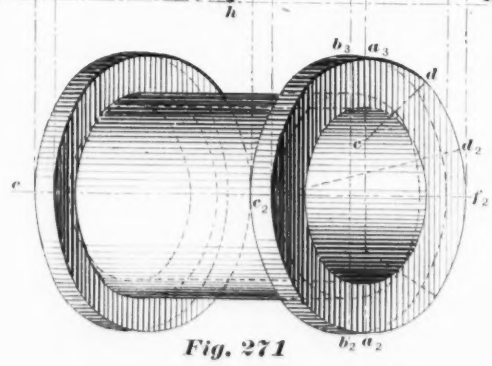


Fig. 271

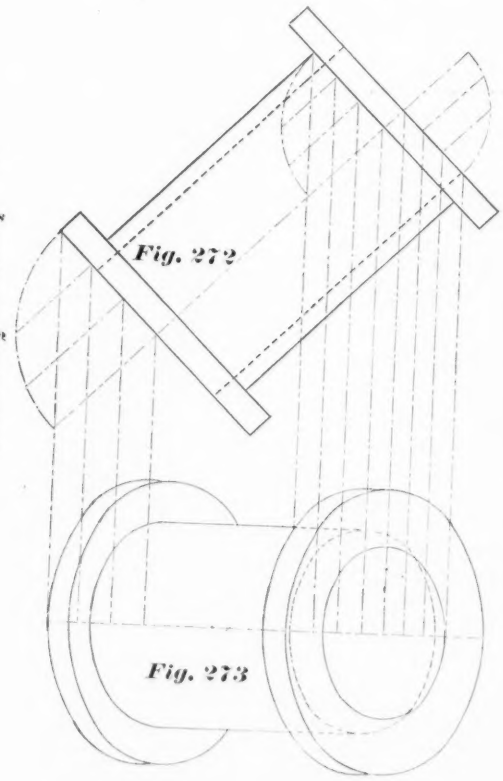


Fig. 272

Fig. 273

Draw any horizontal line $A\ B$ (Fig. 270). Since the point f of the upper flange is to be $5\frac{1}{2}$ inches above the line $A\ B$, draw another line $f\ s$ at a distance of $5\frac{1}{2}$ inches above and parallel to $A\ B$. The total length of the cylinder (including the flanges) is to be 14 inches, therefore from any point h on the line $A\ B$ as a center, and with a radius of 14 inches, describe a short arc cutting the line $f\ s$ in the point f, join the points h and f by a straight line; this line will give the correct inclination of the cylinder. From the point h on the line $h\ f$ lay off a point m; the distance between these points must be equal to the thickness of the flange, namely $1\frac{1}{4}$ inches; also on the line $h\ f$ lay off, $1\frac{1}{4}$ inches from f, a point k. Through the points h, m, k, f; draw lines perpendicular to $h\ f$; to do this use the T and set squares in a manner as illustrated in Figs. 71 and 80. Draw the center line $a\ o$ parallel to, and at a distance of $5\frac{5}{8}$ inches from $h\ f$; again at a distance of $5\frac{3}{8}$ inches from $a\ o$ draw the lines $i\ n$ and $l\ g$, which will complete the vertical projection of the flanges. On each side of the center line $a\ o$, and parallel to it, draw a straight line; the distance between the axis and each one of the lines must be 4 inches, making the total distance between these lines equal to the diameter of the cylinder, namely 8 inches. Also indicate the thickness of the metal in the cylinder by drawing two dotted lines, parallel to $a\ o$, and each line 3 inches away from $a\ o$; these lines will complete the elevation of the flanged cylinder.

In order to find the horizontal projection consider this flanged cylinder to be composed of three separate right cylinders (Art. 299) whose axes lie in one straight line and their bases in contact. Two of these separate cylinders will be represented by the flanges, and therefore each one of these two cylinders will be $1\frac{1}{4}$ inches long and $11\frac{1}{4}$ inches in diameter; the remaining cylinder will be 8 inches in diameter and $11\frac{1}{2}$ inches long. We have now only to find the horizontal projection of each one of these cylinders by the method given in Problem 51, and thus obtain the outline of the flanged cylinder in the horizontal projection.

In Article 18 it is stated that the science of geometry treats on the laws relating to space, and that a geometrical solid is that portion of space which a material object may occupy. Hence, to find the horizontal projection of the hole in the cylinder, we simply consider it to be another right cylinder whose axis coincides with the others, and whose length is limited by the face $f\ g$ and $h\ i$ of the upper and lower flanges, and then find the projection of this cylinder in precisely the same manner as shown in Fig. 268 and explained in Problem 51.

Directions.—In the space marked Prob. 52 draw the vertical and horizontal projections of a flanged cylinder whose position and dimensions will agree with those given in Fig. 270. Use a $1\frac{1}{2}$-inch scale.

The ellipses which represent the horizontal projection of the faces $i\ h$, $n\ m$, $l\ k$, $g\ f$ of the flanges are exactly alike, and therefore we need to find only the points in one ellipse. In drawings of this kind, the points so found can be joined sufficiently accurate by arcs of a circle, and, consequently, when one curve has been drawn in this manner, similar curves can be readily drawn without finding points in each curve. The manner of joining the points by arcs of a circle is explained in Article 379. In the case before us, we have only to find the correct positions of the major and minor axes, and on these establish centers from which the arcs composing the curve can be drawn. Thus: For the horizontal projection of the upper flange we need only find, as is clearly shown in Figs. 270, 271, the position of the major

axes, a_2 a_3 and b_2 b_3, and also the position of the minor axes, and on these axes establish centers from which the arcs can be drawn. The radii of these arcs are indicated by the lines c d and c_2 d_2 in Fig. 271. Similar remarks apply to the ellipses representing the bases of the cylinder between the flanges, and also to the ellipses representing the hole in the cylinder.

378. An ellipse is a perfect symmetrical curve, and therefore, to save time, we need to find only a sufficient number of points to construct one-quarter of the ellipse; that is, the quarter which is limited by the major and minor axes. In Figs. 272 and 273 we have shown how these points of the different curves can be found without confusion of lines. The method shown in these figures is precisely the same as that shown in Fig. 268, and we believe will not need any further explanation.

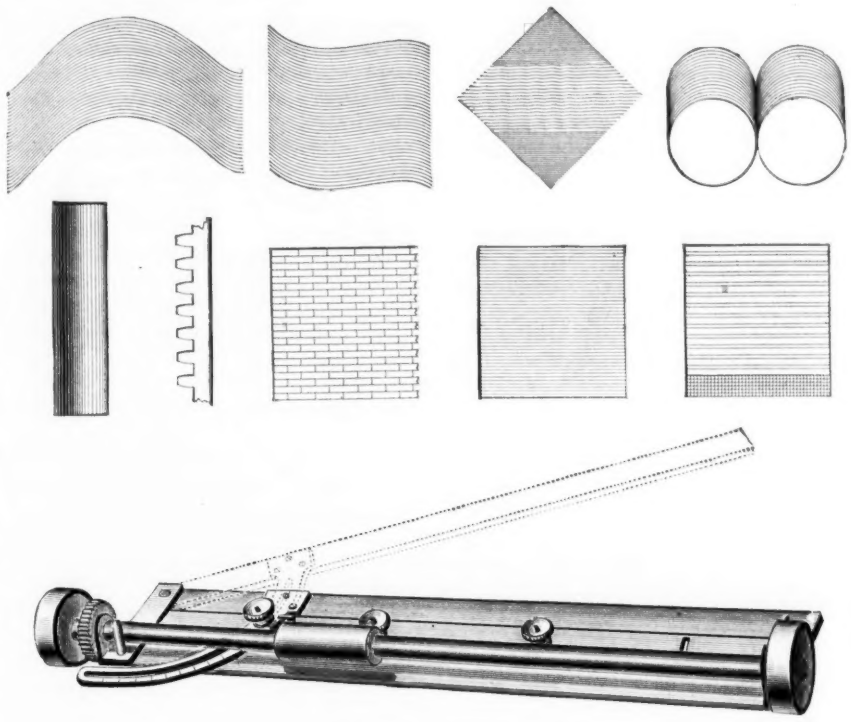
379. *Remarks.*—If great exactness is required, the ellipse must be drawn with the aid of the irregular curves, such as shown in Figs. 128 and 129, or other similar curves, and great care must be taken that the curved line will pass accurately through every point found by the method given in Prob. 51. But this requires a great amount of time, and hence when very great exactness is not required, the draftsman adopts the following method by which time is saved:

It will be found that a curve very similar to the ellipse can be drawn with the compasses by taking two points as centers on the major axis, and two points as centers on the minor axis; thus: Let m_3 n_3 (Fig. 269) be the minor, and o p the major axis, and assume that we have found a number of points such as m_3, e_3, o, i, n_3 and p in the curve by the method given in Problem 51. Now, in order to join these points we find by trial, on the major axis o p a point h, from which as a center we can describe an arc passing through as many points as possible, say from e_3 to i; with the same radius and from the point h_2 as a center—on the major axis—we describe an arc passing through the point p; we also find by trial, on the minor axis m_3 n_3, a point from which as a center, an arc can be described, passing through the point n_3, and as many other points of the curve as possible between i and i_2, and finally with the same radius and from a point—on the minor axis—as a center an arc is drawn, passing through the point m_3. In describing these arcs great care must be taken that the junction of these arcs will occur at the point of tangency, or, in other words, at the junction of any two arcs these arcs must be tangent to each other. From these remarks the reader must not conclude that a true ellipse can be drawn in this manner, but as long as the arcs pass through the extremities of the major and minor axes and through as many points of the ellipse as possible, a curve will be obtained which generally is sufficiently accurate for all practical purposes; of course in these remarks we do not include elliptic gearing, or the presentations of objects where great accuracy is absolutely necessary. After one curve has been drawn and the centers for the arcs established, we can readily draw another curve of the same size by simply drawing correctly the major and minor axes, and locating on these the centers previously found, and then, with the same radii as before, describe the arcs which compose the curve. Sometimes the centers on the minor axis will fall outside of the curve; in such cases prolong the minor axis and locate the centers on this line.

Reports of rich mineral finds in Arizona should be received with a good deal of salt. Arizona is rich in mineral resources, but can produce more talented liars to the square mile than any other portion of the United States.—*St. Louis Republican.*

New Ruler and Section Liner.

The accompanying illustrations represent a new and simple ruler and section liner, also a few samples of work that can be drawn with it.



RULER AND SECTION LINER.

As will be seen, this ruler has attached to its extremities small light journals, in which rests a shaft with a roller fastened to each of its ends. The diameters of these rollers are exactly alike, so that the ruler can be very easily rolled into any position, with its edges always remaining parallel to its first position. So far it is similar to any ordinary parallel ruler. Underneath and at one extremity of the ruler, the end of a small flat spring is fastened; the other end is allowed to fall between the teeth of a ratchet wheel which is fastened to the shaft. This arrangement will allow the ruler to be moved only in a direction opposite to that indicated by the attachment shown in dotted lines, and regulate the spaces between the lines to be drawn.

To draw parallel lines the operator takes hold of the rubber sleeve on the shaft and turns the latter towards himself: as soon as a click is heard he rotates the shaft in the opposite direction, until it stops; of course, only a very slight rotation is necessary to bring it to a stop. Then he will draw the line along the edge of the ruler, and repeat the operation to bring the instrument in position for the next line. Larger spaces may be obtained by allowing the ruler to give more than one click.

For smaller spaces, the spacing device, which is simply a pivoted arm, and may be set to any angle, must be attached to the ruler.

With this device lines can be drawn in any direction, and at a distance apart from $\frac{1}{100}$ of an inch to any desired distance.

For curved or irregular work a curve of the required shape must be attached to the ruler by means of the two thumb-screws in its center, after which the procedure is the same as before.

For parallel circles a soft center point on the right-hand end of the pivoted arm is used, and the circles drawn with an ordinary bow pen.

For shading cylinders the pivoted arm is placed so as to space very short distances. The lines are then drawn, and the distances between them regulated by the number of clicks. For shading cylinders of very large diameter, the spacing device may be thrown out; and in this condition it may also be used as a parallel ruler.

The instrument is made of steel and brass, nickel plated, is claimed to be durable, it can be bought from G. S. Woolman, 116 Fulton street, New York.

Draper's Self-Recording Thermometer.

We illustrate herewith an instrument which automatically keeps an accurate record of the temperature of the place in which it may be placed.

By a clock movement specially made for the purpose, a paper disk is made to revolve at a uniform rate for one week, making in that time exactly one revolution. This disk is divided into equal spaces by radial lines, representing hours and days, and by concentric circles, representing degrees of temperature.

A lever L, Fig. 2, carrying at its extremity a pen, is moved towards the center of the disk by a lower temperature, and outwards towards the periphery by a higher temperature. A red ink line is thus traced upon the disk, its distance from the center at any given radial line denoting the temperature for the day and hour represented by such radial line. At the end of the week the paper disk may be removed and another substituted, by simply removing a milled nut which holds the disk in place.

The construction of the instrument will be understood by reference to Fig. 2, where C represents the clock case, A the clock arbor and W W the winding stems. N N are the thermometric strips; there are two of them, each being composed of two metals fastened together. One of these metals is expanded by heat more than the other, and thus the compound strip is deflected one way by an increase, and the other way by a decrease of temperature. This motion is by means of the platinum wires P P transmitted to the arcs F F and from there to the lever L. The adjusting screws S S are used for bringing the pen to the proper place on the disk to agree with the actual temperature. The outer case is perforated, to admit air freely to the thermometric strips.

One of the instruments was in use in the building during the recent American Institute Fair, and received the "Special Silver Medal," the award being based upon the records kept by the instrument during the six weeks of the fair.

The instrument is being used for a large variety of purposes besides meteorological uses.

Its utility will be apparent for storehouses where a constant temperature is desired, in refrigerating railroad cars, drying rooms, mills, factories, etc., where the proprietor or manager may wish for any reason to know what variations from a given temperature have taken place, and at what time.

The instruments are manufactured by the Draper Manufacturing Co., New York City.

SELF-RECORDING THERMOMETER

Diagram of Recording Thermometer.

[WITH TWO THERMOMETRIC STRIPS.]

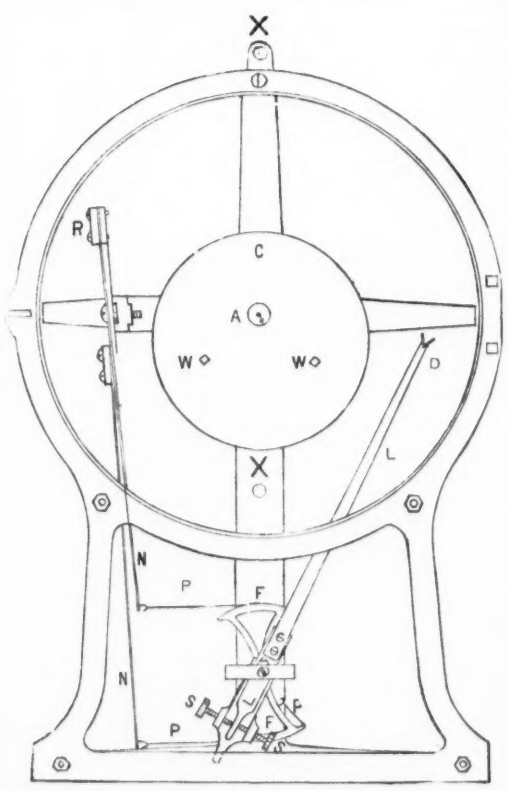


FIG. 2.

Fink in a New Role.

A friend in New Bedford, Mass., writes us that the redoubtable Fink has lately been in that city, "this time among the cloth manufacturers, with a compound for effacing the stains made on cloth by oil, and was successful, in at least one case, in disposing of his formula."

To our inquiry whether he was offering the same old compound for this purpose, and if not, what the formula was, the reply was: "Will try and gain you the information you desire, but people don't like to have a fresh sore touched. Can now only say this, that Fink was to meet the parties the second time at 4 P. M., but he did not put in an appearance."

Our "esteemed contemporaries" are making considerable ado about the corner in tin. Well, we do not produce tin here in quantity sufficient to prevent a corner. But in the instance of copper, which gets cornered all the same, the case is different.

Instructions for Making Patterns from Models, Templets, Plaster Casts, Carved Blocks, Etc.

By S. Bolland.

We will first consider what can be done with the templet and strickle. Fig. 1 is the sketch of a section of top and bottom railing about 9″ wide and ¼″ thick all over. These are made in various lengths, some straight and others curved at one end. A few hours, at most, will serve to make such a pattern as this by the method under consideration, the only outlay for pattern work being the strickle and templet on which it is to travel. First consider a straight piece of pattern, say six feet long, and to the dimensions given for Fig. 1. Let it be the top half. By referring to Fig. 2 it will be seen at a glance. Such as this can be made readily in a flask by securing parallel pieces (planed to a true surface) on the edges of the flask, as seen at *A*. The strickle is shown resting on these pieces, with stop *B* at one end, to guide it straight.

The first thing to be done is to ram the sand very hard in the flask, and strike off the form of top side of pattern; this is the line marked *C* on the strickle. If this is carefully done a true and hard surface is the result. Smooth over and dust on the parting sand, taking care to have no more on than is necessary to part the cope. Let the cope be evenly rammed on this and lifted away. Before proceeding to strike out the thickness the bed must be prepared, as in this condition it would be altogether too hard for the iron to rest on. After such preparation is made, then strike off the thickness, as shown at line marked *D*. I have shown a space outside the web at *E*. This is to aid in securing a good inner edge when the web is deep, leaving the outside to be made up with a piece of pattern the thickness required. All that is needed now is the right man to finish up the mould—one who has made the use of his tools a study. Such a man will turn out a pattern by this method, equal in every respect to the one made from a wooden model; in fact, very often much superior, as there is always great difficulty in keeping such light patterns in shape. Of course blocks can be made to fit them, but this is only adding still more expense; and why incur all this unnecessary outlay when it can be avoided with better results? All that is required when the pattern is to be other than straight is to have the bearings on which the strickle works, made to the required curve or angle. Suppose we want a curve on one end with a rise or a droop; what more simple than to cast two straight edges in lead? With these the problem is solved, for they can be bent to any form desired, and placed at the ends of the parallel straight edges; thus furnishing the working plant for making any form of rail pattern required, or any other of a similar form.

Patterns for lintels, cornices, sills, etc., are usually required to be from ¼″ to ⅜″ thick. If made of wood they are very costly and are easily broken. An excellent method for making all such patterns is shown in Fig. 3, which is a perspective view of the templets *A B*, and strickle *C*, resting on the ends. The pattern intended to be made from these is a lintel, about 6 feet long, 1 foot 6″ wide and 6″ deep, with 10″ rise in the arch. The design is to be as shown on the strickle. The guide stop *D* can be on either side or on both. All that is required to make such a pattern is to level a bed on the floor on which to place the templet, then, after ramming in sufficient sand to form the mould, the strickle, which forms the outside of pattern to be made, must be first used, taking care to have the face true and hard. Should it be required to continue the design at each end, then guides *E* must be screwed on the ends of the templet, on which to work the strickle up and down. When this is done, take away the templet and finish well before the parting sand is used. Of course it requires care in placing the lifters and ramming the cope, so as not to disturb any of the sand model, but when properly done a good impression can be had. When the cope is lifted off, the templet must be replaced, and after the requisite preparations for venting, etc., have been made, proceed to ram the core, and with strickle No. 2 (which must have the required thickness allowed when made) proceed as directed for the outside.

I may be pardoned for again saying that unless a first-class workman be entrusted with this kind of work, good results cannot ensue, as there are so many points to be watched, such as the even ramming, correct finish, and an eye at all times to the draft required to insure a smooth working pattern.

Although I have not shown ends on the templet at Fig. 3, they can be put on when it is thought advantageous.

It will at once be seen that this method may be applied to a wide range of work, and that it costs comparatively nothing for pattern making.

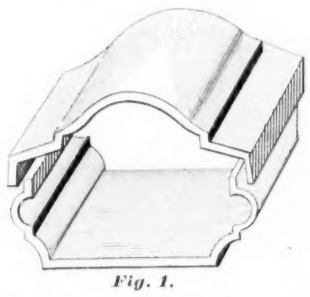


Fig. 1.

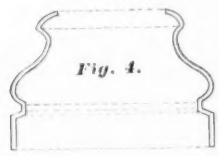


Fig. 4.

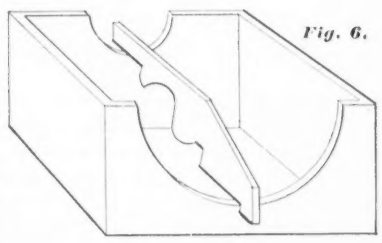


Fig. 6.

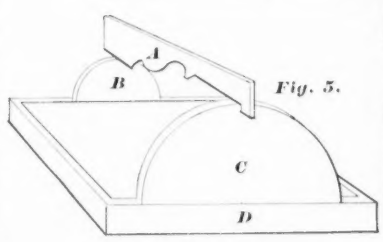


Fig. 5.

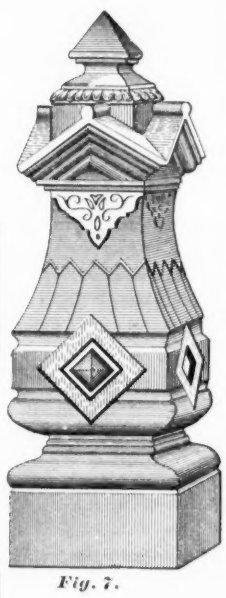


Fig. 7.

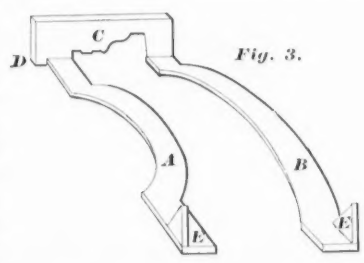


Fig. 3.

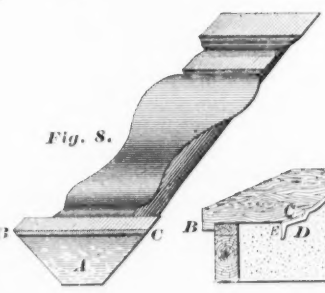


Fig. 8.

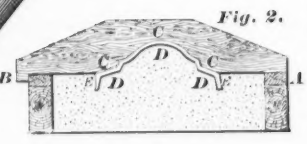


Fig. 2.

The strickle can be made equally efficacious in producing other forms of patterns; for circles are as readily made by it as those we have been considering. Fig. 4 is an elevation of a half base for an 18″ column, $\frac{5}{16}$″ thick. By referring to Fig. 5 it will be seen that such a pattern can be made on the same principle as described for the flat surfaces. The strickle *A* works on circular bearings *B C* attached to the ends of flask *D*. The bearings are to be of the same diameter as the outside of ends of pattern required. The first strickle forms the outside, the impression of which is taken in the cope, after which the thickness is struck off, as before shown. But a much readier way is shown at Fig. 6 to make this pattern; the cope is there shown as the templet instead of the nowel. To do this it is necessary to have the cope barred to suit the job and rammed from the inside, making sure to have the joint good and firm. The first strickle in this case forms the surface in which the core is to be rammed, and after treating it in the same manner as before directed for parting, the nowel is rammed and both parts rolled over together. When the cope is again turned back, strickle No. 2 is used to strike out the thickness, and this, of course, will be the outside of the pattern. As a rule, the latter method is the best, as it gives less trouble in ramming, and secures a better core with less labor. It is right to say here that when method shown at Fig. 6 is adopted, the ends must be of the same diameter as the inside of pattern.

Numerous illustrations might be given to show the adaptibility of this method to the production of other circular patterns, but I feel sure that enough has been said to prove its adequacy; for by slight modifications of the system, almost every emergency may be met successfully.

We will now consider the subject of making cast patterns from models, plaster casts and carved blocks. Fig. 7 is the sketch of a newel post, quite a familiar object, and needs no explanation. My reasons for selecting this post is because it furnishes capital opportunities for illustrating the method of making patterns from carved blocks. This post is supposed to be 12″ square at the base and cap, and 3′ high; such a post is usually made up of four thin slabs about ¼″ thick, mitered at the corners, and held together by internal fastenings. Being sold at so much apiece, it of course behooves the founder to keep them as light as possible, especially as competition in their manufacture is very keen. In fact, however massive any of this class of work may seem, we may rest assured that it is just as thin as the manufacturer knew how to make it. Some of this work is really handsome, and tests the skill of the carver to produce it, but carving out the face side is not the whole difficulty. If (as is sometimes attempted) the back is cut out to the desired thickness all over, the chances are that some parts will be cut through, whilst other parts will not be cut deep enough; and to avoid the former evil, it is considered best to be on the safe side, and the casting is consequently much heavier than it ought to be. All this can be easily remedied by a very simple process. Fig. 8 is the perspective view of a slab of very plain design. It will be seen that in making such a slab from which to mould the pattern, sufficient lumber must be used, either solid or built in layers, to suit the form of pattern, and high enough to leave the block firm after the deepest recesses have been cut out. The block is to be mitered on the sides its whole length, as seen at *A*; the line of thickness is also shown on the end at *B C*, and from this line let the block be well tapered at both ends.

We will now show how to make a cast pattern from this block ¼″ thick. To do so, we require two copes that are an exact fit to the same nowel. Let the block be set face up (convenient for easy moulding) in cope No. 1 in the customary way for rolling over. Ram the nowel very hard and roll over both parts together. In making the joint, be sure of a little surface past the feather edge (for reasons to be explained further on), and be careful to have the joint at the ends exact to the thickness line; this impression must now be taken in cope No. 1, which must also be rammed extra hard. Lift off the cope and lay back on soft sand, draw out the block and proceed to lay in the thickness, which will be made of clay, after this manner: The best clay for the purpose is the red, smooth kind; dry it and pound fine; then sift through a fine sieve and wet to the consistency of stiff putty. Now nail two strips ¼″ thick on a smooth board, as far apart as required, and roll out the clay between. All that is now needed is a knife and a little ingenuity, and the clay may be cut and laid on the hard mould with the greatest accuracy, every part of the surface being correct to thickness. It will now be seen why the bottom was to be rammed so hard the first time, and also why the joint was to be extended past the feather edge; in the latter case, the thickness can stand past the edge a little when laid on, and pared off even with the joint afterwards. Now prepare for parting, and take this impression in cope No. 2. (This will be the top part of mould and the back of pattern.) Should there be intricate parts in the lift, clamp the two parts together and roll them both back on a soft bed. You can now loosen the nowel and lift the sand away carefully without disturbing any of the mould in the cope. When the clay is removed you have a perfect impression. In finishing this, be careful to give good draft where it is needed. The necessity of cope No. 1 is now seen, for the joint in this is the same impress as that in cope No. 2, and nothing remains to be done but to place in the back, bring on the nowel and ram so as to give a good, even casting. When this is turned over, cope No. 1 ends its usefulness by leaving you the joint exactly corresponding with the impression taken in cope No. 2, so that you have an absolute fit when they are placed together, and an even thickness at every part of the pattern. Should the design be very elaborate, with many delicate edges, it will facilitate the thicknessing very much if a coat of plaster be run over the pattern instead of the hard ramming as directed, thus leaving a good hard face to lay the clay to. This is the best where there is very fine carving, and the pattern is to be extra light, such as for ornaments, fine mouldings and all patterns for decorative purposes.

When the model covers a large space it is customary for the designer to have it cast in plaster sections to insure easy and safe shipments. To make a pattern from such sections it will (in the majority of instances) be found best to cast the face in the cope. These sections will have no regular form on the back, as there is no particular attention paid to that part of the model, only to have sufficient body of plaster to take in the deepest recesses; it will therefore require some modifications of the previous instructions to make such patterns face side up. Let the nowel be placed on the floor and proceed to arrange the sections of model (face up) in such a manner as will be most convenient for moulding, and be sure that all the several pieces have a solid bearing, so that the ramming of the cope will not disturb any of them. As before, there will be copes No. 1 and No. 2 in this case. After the joint has been rammed very hard it must be formed carefully all round and the whole face prepared for separation. Cope No. 1 will be now used, and as this will be for the mould proper, every precaution must be taken to secure a good face; and when rammed it must be lifted off and placed aside. Now bring on cope No. 2 and be sure to ram the face of this as hard as possible; when this is laid back on the floor the clay thickness is to be laid on accurately all over the impress of model as before shown, and after the necessary preparations for an easy separation have been made the nowel must be rammed, due precautions being taken to secure a good mould. The whole can now be rolled back and the cope lifted off carefully, so as not to disturb any of the mould under the clay. Nothing more is required but to finish cope No. 1 and the nowel and then close. The joints of course will correspond, for although the nowel joint is the impress of cope No. 2, it must be remembered that both copes were rammed on the same joint, before the

nowel was lifted to be rammed on cope No. 2.

I shall be excused, I think, for so much apparent repetition in these instructions, because I know that, to those who have had no experience in this class of work, there seems more or less mystery in the use of two copes; but a little thought will overcome all this and the whole thing appear in all its simplicity. To foundries where no pattern makers are employed a knowledge of the methods is indispensable, as it places them (so far as this class of work is concerned) on an equal footing with the best equipped firms.

To conclude I would say that many ingenious contrivances will suggest themselves to the moulder engaged on this line of work; as, for instance, a rough block with bearings for a strickle to work on can be struck off in plaster to any design which runs the same along its whole length; this can be used as a model and backed out with clay thickness as directed. All such patterns as are shown at Fig. 1 can be treated this way, thereby enabling the moulder to choose either the method explained at Fig. 2 or the one just considered. In fact, this article is but a mere outline of what can be done by these methods; for when once entered into it will be found that scarcely any limit can be placed to its usefulness.

Good Advice.

In the copy of the constitution and by-laws of a mutual benefit association sent us by Bausch & Lomb Optical Co., of Rochester, N. Y., is a loose leaf not belonging to the copy referred to. From this leaf we learn that this firm has established a library consisting of books, newspapers, periodicals, etc., for the use of their employes. On this leaf are printed a few very simple rules to be observed by those making use of the library—rules in which any intention to hedge about the use of the library by annoying conditions is conspicuously absent. Then follows this advice, which is worthy of being given wide publicity. We think nothing better could be got into the same space:

"Read something useful every day, if only for a few minutes.

"Read not too fast, nor too much at a time.

"Read attentively, thoughtfully; by inattention you waste your time and injure your memory.

"Stop occasionally, after you have read a short time; see whether you remember the substance, the ideas, of what you have read—if not, or if you do not understand it properly, read it over again, think it over, and try to retain the most important part in your memory.

"Have a note book at hand, and copy into it some of the choicest and most important passages or expressions you have read, with page and name of book selected from; or write down your thoughts about what you have read. Of papers you may cut out these parts if you have permission to do so

"Separate and arrange occasionally your notes and papers according to the subjects treated.

"The company trusts that their employes will assist as much as they can in keeping the library in as good a condition as possible; that they will employ some of their leisure time in making use of the same, and by so doing secure to themselves hours of pleasure, as well as useful knowledge, valuable to them in daily life."

A New Society.

A society known as "The New England Foundry Association" was recently brought into existence, at a meeting of some 75 foremen of brass and iron foundries, at Springfield, Mass. The greatest interest was manifested at the meeting, and the new society starts under excellent prospects for success. John P. Pero was mainly instrumental in getting the men together to form the society. The society is modeled after the American Society of Mechanical Engineers. Regular meetings will be held at stated intervals, at which papers will be read and topics relating to foundry practice discussed. Following are the officers of the new society: President, Isaac Winchester, of Boston; vice-presidents, N. Barton of Norwich, Conn., R. H. Palmer, of Providence, R. I.; secretary, J. P. Pero, Stamford, Conn.; treasurer, Frank Gibby, Boston, Mass.; councilors, Frank Davey, Bristol, Conn., Joseph Hennessey, Chicopee Falls, Mass.; managers, J. B. Pero, Indian Orchard, Mass.; Jno. Witherell, Florence, Mass.; Thos. King, Meriden, Conn.; J. S. Richardson, Rutland, Vt.; H. B. Murless, Rockville, Conn.

The next meeting of the society will be at Worcester, Mass., July 2.

A Good Appointment.

Charles A. Bauer, general manager of the Wardner, Bushnell & Glessner Works, at Springfield, Ohio, has been appointed one of the commissioners of the machinery department of the forthcoming centennial of Ohio. The officers of the department of machinery should receive credit for appointing a man of Mr. Bauer's well-known mechanical and business ability to this place. Such appointments will go a long way towards establishing confidence in the enterprise, and are in pleasing contrast to those sometimes made for similar purposes.

Mr. Robert E. Masters, well known to our readers, has accepted a new position. The following, from the Richmond *Whig*, will explain:

"Mr. Robert E. Masters has been appointed general superintendent of the Marshall Car Wheel and Foundry Company's plant at Marshall, Texas, and in consequence has resigned his position as manager of the cast-iron department of the Tredegar Iron Works, to take effect on the 31st of this month.

"As an expert in the mixture of metals and in the management of men and work pertaining to foundry practice, Mr. Masters is said to have no superior. His practical, illustrated articles in the AMERICAN MACHINIST for several years past, has made his name familiar to foundrymen and iron workers on both continents. The men under him, as well as the company and the numerous friends he has made in this city, by his urbanity of manner and genial disposition, will sincerely regret his departure for the South."

A Monster Magnet.

One of our leading army engineers has brought before the engineers' classes of late an experiment of startling nature. Wonderful results are promised. It is a monster magnet made of two Rodman guns, which are connected at the breech. Around them is wound about twenty miles of submarine cable. The cable is some that has been used in the torpedo service. It is wound and fastened in a substantial manner, making a powerful electro-magnet when electricity is applied, that shows strange results. For instance, a bar of railroad iron thirty feet long, if placed in the open cannon's mouth, cannot be drawn out by all the many men that can grasp it. Another instance of the strength of this big magnet was illustrated Saturday with a 350 pound cannon ball. The shot was placed in the mouth of one of the cannons, the negative side of the magnet. On reversing the electric current it fell from its position, but was attracted to the opposite cannon and clung to its side. The positive current was then reversed alternately with the negative, and the heavy cannon ball played between the two cannons like a tack between the poles of a toy magnet.—*Boston Herald.*

A correspondent of *The Engineer* calls attention to the fact that the French system of measurement was legalized in the United States in 1886. We call attention to this fact, because there is nothing in the way measuring is done by ordinary mortals in this country to-day, to remind them of it, and they might lose sight of it. There is always the old difference between leading a horse to water and making him drink.

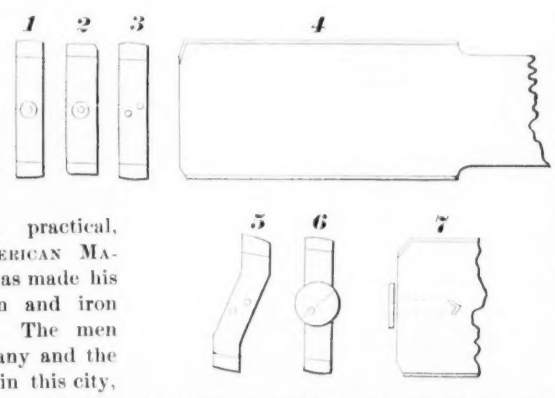
Something About Chucking Drills.

BY FRANK H. RICHARDS.

The makers of small machine tools—the successful and established makers—accomplish a great good for the trade other than that which arises directly from the diffusion of their own products. They do much to raise the general standard of excellence in such articles. The taps and drills and reamers offered ready-made to our hands to-day are so good that even those that we make for ourselves are better than those we would have made or expected twenty years ago. The ideas of the trade are unconsciously enlarged continually, and the criterion of means and of accomplishment becomes more exacting. There are no articles that I think of that are better in their way than the reamers of the best makers. Taps are by no means so satisfactory.

Years ago I used to find chuck or chucking drills advertised; lately I have been looking through a number of trade catalogues and have not discovered them anywhere. I suppose that when they have been offered to the trade there has not been much sale for them because they are such a simple article. Anybody can make a chuck drill, is the general impression; consequently anybody and everybody do make them, and we find them scattered through our shops in every grade of inefficiency.

The importance of the chuck drill as a time-saver can scarcely be overstated. In



the sharp competition of the pulley trade, for instance, the man who would bore his pulleys with a boring tool would be driven out of the market. Of course the chuck drill's great field is in boring cast-iron, and it is no exaggeration to say that in work to which they are adapted, in size, depth of hole, material to be cut, etc., good drills rightly made and properly used will do four times the work that can be done with the boring tool. As, for the moment, the champion of the chuck drill, I would like nothing better than a chance for a "race" with a boring tool upon the above basis. It will pay establishments of any size, then, to put enough expense into the making of their drills to have them right, and to enforce sufficient care over them to keep them in good condition.

An important point not to be lost sight of is that chuck drills, at their best, can only do their best with the co operation of the pattern shop and the foundry. Cored holes must be of suitable size; not too large, so that the drills have to run upon sand and scale, and they should be as true as possible. But the worst and most fatal antagonist the drill can encounter is hard iron. Against this foe it is helpless, and in the contest it is inevitably defeated. The cents saved and the dollars lost through hard iron, could they be computed, would appall the most thoughtless. I wonder how many miserable machinists have been prematurely driven to their graves, how many once prosperous machine shops have been wiped off the face of the earth by hard iron.

The thoughtless impression that the "points" of the chuck drill are unimportant, and that anything that can be crowded through a hole is good enough, is far from the actual fact. I believe, and am prepared to maintain, that the chuck drill requires as much care and skill in the making as most tools, and that to maintain it in good condition and efficiency calls for unusual resolution and vigilance.

Chuck drills should generally be used in sets of three. For some small work in clean and true castings two will do very well. The first drill wears much faster than the others, but should be kept sharp and true, as the more it does toward straightening and truing the hole the better it will be for the others, and the more satisfactory the final result. The first drill should do the heaviest cutting, while very little should be left for the last, so that it may maintain its size and not throw too much work upon the reamer which is to follow it.

The chuck drill should be forged flat, usuallly of an uniform thickness throughout its length, and with the head large enough to be turned to the desired size and the remainder of the drill small enough to pass freely into the hole it bores. The head may be in length three times the diameter, when it may be worn back twice the diameter before renewing. The drills should be turned, each to its required size, perfectly straight and true, and square at the end, the cutting corner beveled as wide as the expected cut, and this beveled corner filed or ground back enough to give it clearance, and the drill then hardened The drill, Fig. 1, will then be in the best possible condition for boring a true hole. The only objection to it is that it will not work. If it could be once started true it must make a hole nearly true to any reasonable depth, for its turned edge against the side of the hole already trued would not allow it to get out of the way sidewise. But we find upon trying to force it into the hole, that the friction at the edge is so great that it goes very hard and continually harder, that it heats up, and both the drill and the hole are roughened and abraded by the dust which forces between them.

After turning the drill large enough to admit of it I would first grind it true to the circle, the grinding giving a better surface than any turning or filing will do. This calls for a grinding machine of some sort, and in these days it is a necessary item of machine-shop equipment. I would then mount the drill upon eccentric centers, Fig. 3, a center for grinding each edge, which will give it the necessary clearance and allow the opposite edge to swing by the wheel without touching. Upon the eccentric center the edge is ground until the original concentric grinding just disappears. Centers exactly corresponding are of course required for each end of the drill. The amount of eccentricity required is not great, Fig. 3 being somewhat exaggerated, and it is not always practicable to have, or at least to preserve, these centers in the drill. Many devices for the purpose will suggest themselves. I have done very well, as shown in Figs. 6 and 7. In each end of the drill I have a hole $\frac{3}{16}$" diameter, and into this I insert the pin which carries the center, turning it half way around to grind the other lip.

When the drill has been made and ground to the desired size, and with the necessary clearance, it should thereafter, as it wears, be ground only at the end. When the angle of the cutting lip has been established, as it is when the drill is rightly made, it is necessary to insist upon maintaining the angle as established. The outer corner of the drill of course wears first and most, because it is always cutting when the drill is in use, while further in toward the center the lip may or may not be cutting, as the untruth and irregularity of the preceding hole may vary. The outer corner of the drill being most worn, the industrious machinist who goes to grind it naturally grinds it most where it is most worn, as any sensible person would, and in his hurry to get back to his lathe, is very likely to change for the

worse the cutting angle, by swinging it further back. I have seen drills started at 15° from a right angle, and, after a few hasty grindings, carried far beyond 45°. Now I cannot think it necessary to show how the drill is impaired by carrying the angle of the cutting lip back. If the drill were made perfectly square at the end, and with a little clearance under the cutting lip, to allow it to advance into the hole, and if it were started true with enough stock in the hole to enable it to hold a cut all the way round, no matter if it had double as much cut upon one side of the hole as it had upon the other, the heavier cut would have no perceptible tendency to crowd the drill sidewise, and it would walk straight a nd make a comparatively true hole at the first trial. But as soon as we begin to bevel back the cutting lip, the resistance of the cut to the force behind the drill pushing it forward, has a tendency to crowd the drill sidewise; the side where the cut is heaviest thrusting the drill sidewise the most. Then, if the drill has been made with excessive clearance at the side, so that it has a sharp cutting edge the whole length of it, Fig. 2, the side thrust makes it cut away the side of the hole already bored, and by the time it gets through the hole it may be far from true. The ideal, then, for a true boring chuck drill is a square ended one; but it will be found that some bevel at the end will make the drill cut easier, and allow the chips to roll away more freely. The permissible bevel should be fixed by gauge, and never allowed to go beyond it. No matter how much of a hurry a machinist may be in, he should grind a drill honestly. Let the drill never be ground more than 20° back from a right angle, and it would be better to fix it at 15°.

The purpose of the drill is, first of all, to bore holes and to bore them as truly and as rapidly as possible. It may be that some other shape or change of detail would make it last longer, and allow it to return to the tool room in better condition; but to prolong its life at the sacrifice of its efficiency is anything but wisdom. If the drill is made too thick, it is less likely to break; it may spring less in use, it may be returned to the tool room in better condition after a day's use than if it were thinner, but in the day it may have done only one-half the work that the thinner drill would have done. I am speaking of the advantage of the thin drill merely over one that is excessively thick; I of course would not have it too thin. The drill should be thick enough to properly resist torsion with the drill rest as close to the work as possible, and I would not depend upon its thickness and stiffness, but rather upon the truth and perfection of its edges to guide it as truly as possible in the hole.

Chuck drills should be made as hard as possible, compatible with safety. We use them generally without drawing the temper, and seldom have one break.

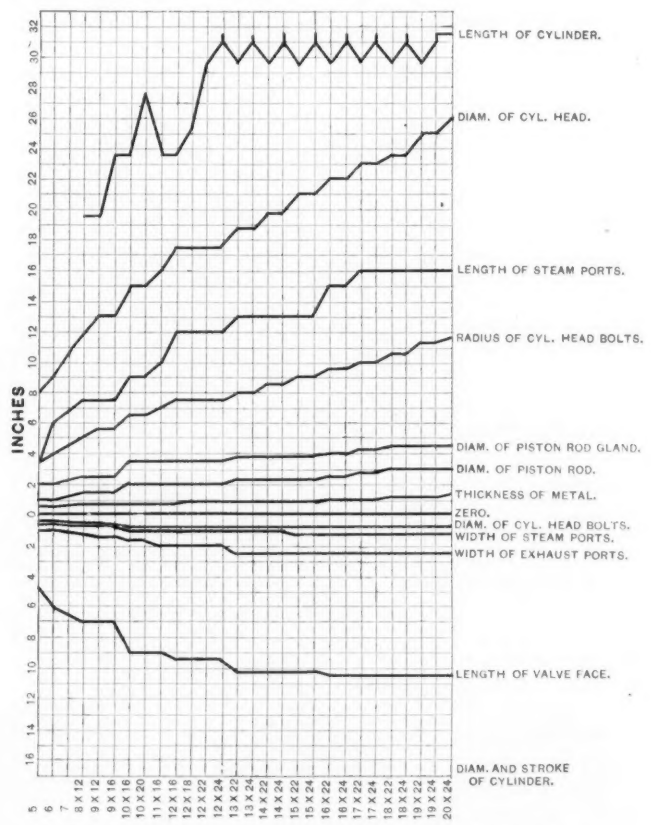
But if I were going to put chuck drills upon the market, I would make the cutting end in section, like Fig. 5. In fact, they need not have any head or special cutting part, but might be made parallel, and could be continually ground back until they were used up. This shape would be better than the common flat drill. It would cut easier, and, on account of cutting easier, would not heat up as much, and the flat at the back corner would make a smooth bearing in the drill rest, instead of the sharp corner digging in as with the flat drill. With the flat drill, the sharp corner should be beveled a little, so that it will not cut into the drill rest, and the slot of the rest or holder should be as narrow as possible, so that it will still let the drill move freely in it. A drill rest with an adjustable slot is a convenience for this purpose. Some twenty-five years ago I was using a patented article that I liked very well, but do not find in use now. Each side of the slot was independently adjustable, and the slotted head was also jointed so that it could be swung out of the way when a reamer was to be used. This was a good thing, because the adjustment of the height of the slot to the center of the hole is important, and when once adjusted by this means, it would remain right. If the lathe carriage is not of the tilting kind, or has not some ready device to raise and lower the tool post, it is difficult to set the solid slot just right; and, as usually happens in such cases, pretty near is good enough.

LETTERS FROM PRACTICAL MEN.

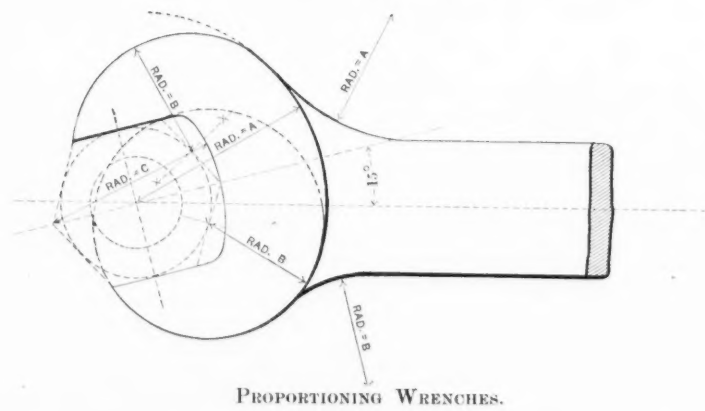
Proportioning Shop Tools.

Editor American Machinist:

I would like to add my endorsement to what you say about "proportioning shop tools," in your issue of Dec. 3d. This scale of proportions may be used for many purposes besides what you mention. The late Mr. Briggs adopted scales of this description for standard pipe fittings, elbows, tees, crosses, valves, etc. Enclosed please find original tracing representing my own first efforts in that direction in proportions for locomotive cylinders.



SCALE OF PROPORTIONS FOR LOCOMOTIVE CYLINDERS.



PROPORTIONING WRENCHES.

I beg to differ with you, however, in regard to the design of your standard wrench. Enclosed is a sketch of a wrench head proportioned from the nut, and is so simple as to need no description, further than to say that rad. *B* is struck from center of flat of nut. Would also recommend placing the head at an angle of 15° with the handle, that being the best position for turning the nut where you cannot get a full swing with the handle. In locomotive practice they usually make the wrenches double headed. I do not see why that could not be adopted with advantage of economy in tools and engines. Is not your formula, $L = 7\ D$, rather short for the handle? This, for a 1-inch wrench, would = $11\frac{3}{8}$ inches. The table I have calls for a 1-inch wrench to be $14\frac{1}{4}$ inches.

T. EVERETT AUSTIN.

Philadelphia.

[In presenting the formula for wrenches, I did not do so with the idea that it was the best possible form of wrench, although I believe it to be a very good one. The entire article referred to was upon the subject of the importance of having *some* design rather than none, and of having a method by which that design, when adopted, could be easily adhered to, and thus uniformity secured.

Of course some wrenches should have the heads at an angle of 15°, but I do not think that all wrenches should be so made.

As to Mr. Austin's question about the length of the wrench, I will submit a few figures from which a satisfactory conclusion may perhaps be drawn.

The length of a $1\frac{1}{2}''$ wrench will be, as Mr. Austin says, $11\frac{3}{8}''$. We will consider its effective length to be 10″, and the point at which the power is applied will describe circle 62″ + in circumference, and in doing this the nut will be screwed down $\frac{1}{8}''$ (a standard inch bolt having 8 threads per inch,) so that, barring friction, one pound force applied to the wrench will equal 8 × 62 = 496 pounds stress on the bolt. Now, supposing a man exerts 50 pounds force on the wrench, the stress on the bolt will be 496 × 50 = 24,800 pounds: allowing 70 per cent. of this for friction, we have for actual stress 7.440 pounds. The area of a one-inch bolt at the bottom of the thread is .55 square inches, and this gives us a stress on the bolt equal to 13,527 pounds per square inch. This exceeds the usual stress allowed upon wrought-iron by 3,527 pounds; 10,000 pounds per square inch being the usual limit allowed.

Now it will be conceded that 50 pounds is a small allowance for the force which will be exerted by a man in tightening up a nut; I believe such force frequently reaches twice that amount at least.

Then, too, 70 per cent. is probably a liberal allowance for friction under ordinary circumstances, and, in fact, is about the highest percentage claimed, Prof. Ball, in his work on Experimental Mechanics, giving it at 64 per cent.

It is thus made apparent that there is a pretty fair basis for saying the length as given is ample under all ordinary circumstances. F. J. M.]

Exhaust Heating.

Editor American Machinist:

The communication of Frederic A. Halsey, as illustrated in No. 51 on page 6, and adopted at the works of the Rand Drill Co., showing the proper manner for heating by the exhaust steam so as to avoid back pressure, is not new, as it has been used in Philadelphia for the last twenty years. I so fitted up a factory, that in place of any back pressure, the indicator cards showed a partial vacuum due to the large surface presented by the heating coils, which condensed all the exhaust the engine delivered, and kept the mill warm. In this city a large number of private houses are heated on this plan direct from the boiler.

The usual practice is to run a large main from the boiler vertically to the top of the house to be heated, with suitable outlets on each floor; these outlets are connected to the manifolds of the coils at the top, and the bottom manifolds are connected direct by proper pipes back again to the boiler.

The result of the above is that there is a direct fall from the main vertical pipe through the manifold coils to the boiler, thus having a noiseless heating apparatus. Large buildings in this city are so arranged, and with a boiler pressure not exceeding five pounds per square inch are comfortably heated—notably the University of Pennsylvania.

I know of a large number of private houses that are comfortably heated, and the steam gauge does not indicate any pressure whatever.

W. BARNET LE VAN.

Philadelphia, Pa.

Drill Presses.—Cheap Tools.

Editor American Machinist:

J. J. Grant, I see, comes around kicking about drill presses, which is very good in him, because the drill press always has been the most abused tool in the shop, and I don't want to see it lose its reputation. I don't think I would want any such clumsy-looking tool as he pictures in Fig. 2 (Dec. 3). though. I wonder if he knows that the column of a drill don't spring once, where the base does twenty times. He is right on the "cheap" question, though, and I think that is where our tool builders are making a great mistake. No machine can be made accurate, convenient and durable, and be "cheap," as the term is now being applied in "mechanics." The builders of cheap machine tools are not going to last forever. The present craze for things that are cheap will eventually blow over, and then those who are progressive, and have seen all the errors in cheap work, will go at it right and build good tools and make them right, with a fair profit and at wages to men so they can save for a wet day. Then their customers will buy the second and third time, and, what is better, they will "brag" about the work without being asked.

We can go into shop after shop in the West and hear the proprietor say as he points to some particular tool: "They ain't worth a cent. I was swindled on those tools." Then we ask him if they were not "cheap," and the subject is immediately dropped. A dollar is only a dollar, and it is no use for us to try and get two dollars for it.

What I do kick about, though, is the fact that we are not turning out enough practical all-around mechanics, while we are turning specialists out of the shops by car-load lots. Our future engineer is coming to us from the schools, with his head full of theories that are not worth a three dollar a week salary, and that is about all he gets until he learns. He can chase parallel lines into infinity and back again, but if we ask him to make a wedge to split a "two foot" log, why, he can't do it, because the thing won't figure out theoretically.

If I had a boy I would give him the best schooling and education possible until he was at the age of sixteen, constantly instill-

ing into his mind that "knowledge is power." Then a four years' apprenticeship in a general workshop, at the same time following the course of instruction by Mr. Meyer in the AMERICAN MACHINIST. Then he should have a four years' experience in the train service of the Pennsylvania Railroad, to learn perfect system and self control, and the value of hardlabor; by that time he would be anxious to get back to his original place in the mechanical world,and be determined that his future salvation was in getting to the top of the ladder in mechanical engineering, and getting there quick too.

GRUMBLER.

Keeping Boilers Clean.

Editor American Machinist:

L. F. Lyne gives his experience in the use of kerosene oil in boilers. I myself have tried the crude oil and found it very good in preventing the scaling of boilers, but the best thing I have ever used was the discharge water from a vacuum pan in a sugar house. I ran a pipe from the overflow tank to my feed pump, and once a day would give the boilers a charge. There is just enough acid in the vapor from the pan to remove the scale, but it will not injure the iron.

If this should be seen by any old Cuban engineer, it will call to mind how we used the crude molasses years ago to remove scale, and the consequence when we got too much in boiler; as it would go over into the cylinders, and that meant a stop.

R. H. A.

Work Done on Milling Machines.

Editor American Machinist:

After reading the article of John J. Grant on uses of milling machines, I want to state my experience with a gang of them used for milling joints for buggy tops. One set of mills last one month, making 600 joints per day, or 15,600 joints per month. Two machines mill the form, each machine milling half the circle, the third slotting the pieces, this being one half the joint; then these machines make the other half only, the third machine cuts the tongue. One boy runs three machines and receives 15 cents per hundred. The mills are sharpened once a week, costing 75 cents to sharpen. Then at the end of one month the mills are annealed and worked over. I have two sets of cutters that have been working this way for one year, making nearly 200,000 joints, or 400,000 good pieces, for there are two pieces to one joint, and of course there are some spoiled, which are not counted.

Cincinnati. JAS. D. HUBBELL.

The Illinois Railroad Commissioners have arrived at a decision respecting the Chatsworth horror, and among other important facts stated in their report is the announcement that "the train would not have been destroyed if the bridge had not burned before the train reached it."

Such an elucidation of the matter must be very comforting to those who lost friends in the accident. If one's friends must be crowded into excursion trains and run through burning bridges and killed, it is, of course, some consolation to be thus officially informed that if the bridge had not burned until after the train had passed over it, then the train would probably have passed over it in safety.

Don't Forget the Signature.

We have received, from a well-known firm of machine tool builders, the following letter, recently received by the firm. We omit date and location:

Several mechanics in this city formed a company and got building and site, for a shop, and are going to start in the spring. Please send me your catalogue of lathes, planers, shapers and drills, with discounts for spot cash. We want lathes from 20 to 48 inch swing; planers, 30x30 to 48x48, platen about 10 to 16 ft.

It will be noticed that the only peculiarity in the above letter is the absence of any signature; nothing whatever indicates to whom the catalogue should be addressed. This omission is by no means so uncommon as might be believed. The firm referred to write us that they frequently receive such letters. We receive them at this office every day. As we cannot pay attention to communications unless we know the name of the writer, an average of several hundred each year go to waste.

Undoubtedly many applications to manufacturers for catalogues are unattended to for similar reasons.

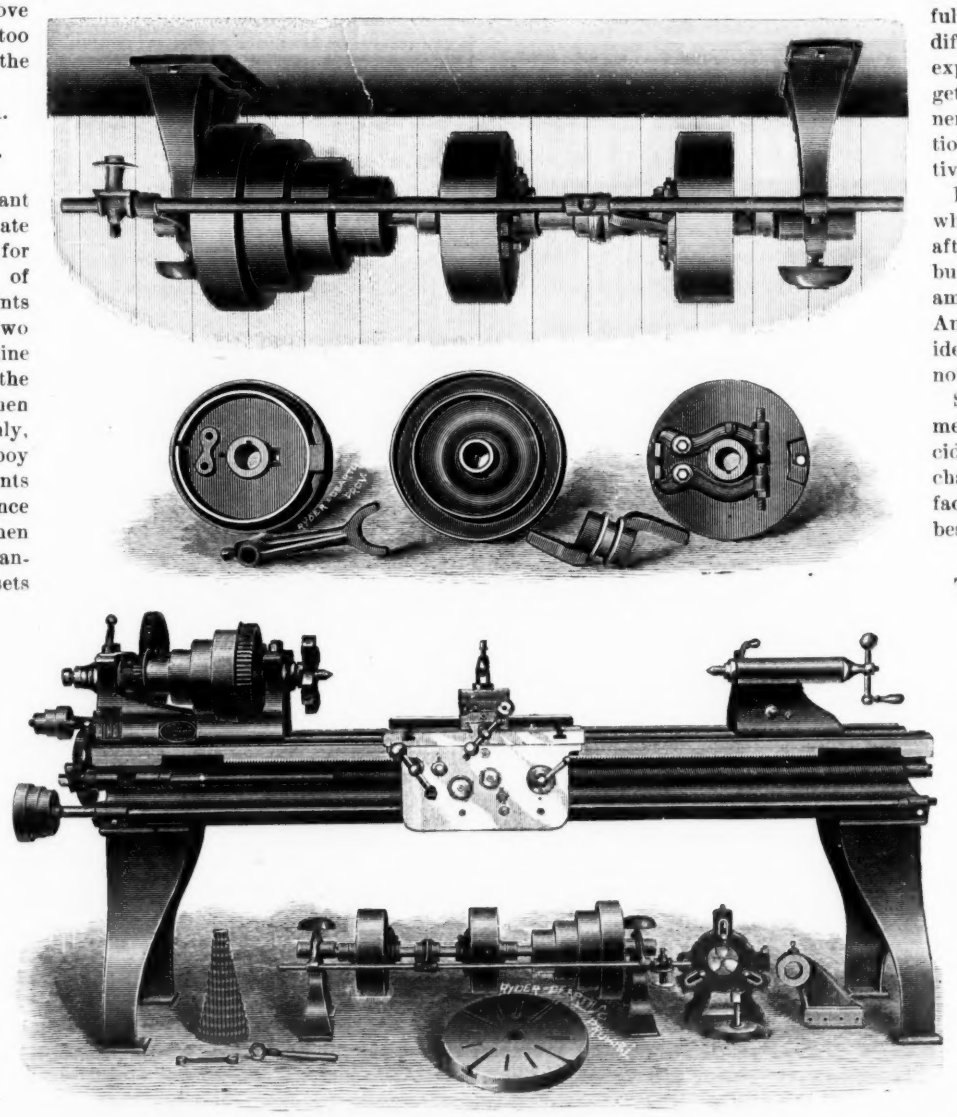
The moral is: Always give your address. We might add to this: Always sign your name plainly. Most other words can be deciphered, but a name written illegibly will puzzle the most expert.

New 16-Inch Engine Lathe.

The cuts presented herewith show a lathe recently brought out by Nicholson & Waterman, of Providence, R. I.

As will be seen by reference to the cut, the lathe is of a neat and substantial design. It is furnished with independent rod and screw feed, and improved friction clutch countershaft.

The carriage is gibbed to the bed front and back, has automatic cross feed, simple and substantial apron gearing, and T-slots for fastening on attachments or work to be bored by a bar.



NEW 16-INCH ENGINE LATHE.

The lead screw is of steel, of large diameter, and has an improved device for taking up end motion, and an open and shut nut operated by a lever.

The spindles are made of hammered steel, the head-stock spindle running in composition bearings, and having a hole $1\frac{1}{16}$ inches diameter through its entire length. The front bearing is $4\frac{1}{2}$ inches long by $2\frac{1}{2}$ inches diameter, the rear bearing being $3\frac{1}{2}$ inches long by $1\frac{3}{4}$ inches diameter.

Both of these bearings are ground, and the boxes scraped to a bearing.

The foot-stock spindle is 13 inches long, 2 inches diameter, and has a bearing over its entire length.

The cone pulley has four steps for a $2\frac{1}{2}$-inch belt, its largest diameter being 11 inches.

Change gears are furnished for cutting all pitches from 2 to 24 to the inch, and, by means of an additional stud, threads can be cut up to 48 pitch.

The lathe swings over the carriage 11 inches, and with an 8-foot bed takes between centers 4 feet 9 inches.

A locking device is provided for the carriage, by which it is held in position when using the cross-feed.

American vs. English Locomotives.

The question of the comparative merits of American and English locomotives seems to be receiving a great deal of attention in England just now, and they seem to be more and more convinced over there that in neutral markets the English cannot successfully compete with the American locomotive, being not only inferior for actual service, but higher in price.

Most of the English writers have attempted to deny or explain away these facts, claiming that the English locomotive was really far better, if only people outside of England could be made to see it, and that its higher cost was simply the necessary result of its better construction.

A correspondent of *Engineering*, in a recent communication to that journal, however, takes a different view of the matter, and is candid enough to state things about as they are. He starts out by saying: "The fact of the American locomotive, handicapped as it is at present by higher cost of wages and material, and less facilities for shipment, being able to enter into and to sustain a successful competition in neutral markets with the English locomotive, demonstrates that it must possess some inherent advantages which can hardly be better described than by the word superiority, disagreeable as that word may sound to English ears when so applied."

He then goes on to say that English locomotives are too stiff to go around curves easily, and, as a result, destroy themselves and the road where there are many curves, and that in this respect the American locomotive is far sueprior on account of its bogie, which we call the forward truck.

He thinks, also, that the inferiority of the accommodation provided for the engineer tells heavily against the English locomotive in foreign markets, which is undoubtedly true. An engine, having a cab so constructed as to expose the engineer to unnecessary discomforts, is not so apt to receive his approval as one which is better arranged in this respect, and in the introduction of any machine, it is of prime importance that the man who is to manage and care for it should be pleased with it, and that every possible cause of annoyance to him should be avoided.

This writer then takes up the argument that has been advanced by some Englishmen, that English workmen must work at smaller wages and longer hours, to reduce the cost of production, and shows that the trouble is not to be remedied in that way, and that the whole fault is with the designer, and not with the workman, since the machine is so made as to involve a great deal of expensive labor which is useless. He says: "The successful working of American locomotives proves that the designs on which they are made, the materials of which they are constructed, and the manner in which these are put together, are sufficient for every useful purpose; it is therefore by following different designs, by employing unnecessary, expensive materials, and putting them together in an unnecessarily laborious manner, that we suffer in commercial competition with Americans in supplying locomotives."

He mentions the case of a car works there, where "center buffers, coupling with a link, after the American plan, were being made, but of a pattern that involved ten times the amount of labor there is in the ordinary American coupling buffers from which the idea was taken, and the result was an article not as good as the American buffer."

Such statements, coming from an English mechanic, are very significant, and are decidedly complimentary to American mechanics, and a further illustration of their faculty of adapting means to ends in the best possible manner.

The *Colliery Engineer* has issued an extra sheet, giving statistics regarding the production of anthracite and bituminous coal in Pennsylvania during the year 1886. According to the figures, the number of men employed inside the mines was 107,018, and the number outside 48,390; a total of 155,408. The production of coal was 61,884,791 tons. In view of the small wages paid at the mines—sixty to ninety cents per day—it is interesting to note that the men were employed less than two-thirds of the time. Regarding the danger to life, there were in the anthracite mines one fatal accident for each 370 persons employed, and one non-fatal accident for each 122. As these figures of killed and wounded include those employed outside the mines—where the danger is much less—as well as those inside, they are not likely to reassure men whose inclination is to work at coal mining.

An example of deterioration in values is shown in the recent sale of the Great Eastern for $100,000. The original cost of the vessel was $3\frac{1}{2}$ million dollars, but she was a gigantic failure from the start. The building of this ship, however, was of value in demonstrating that there was a limit in steamships in the direction of size. While those who invested their money in building this ship lost heavily in the venture, they can console themselves with the fact that their loss was not altogether in vain. Their example has been profited by.

In England there is an early closing bill before Parliament, and public meetings are being held in favor of the movement. Shop girls and clerks, it is said, work from thirteen to fourteen hours per day.

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The Close of Volume X.

This number of the AMERICAN MACHINIST completes the tenth yearly volume, and with it will be found the index for the year 1887. This index has been prepared with a view to enabling readers to find articles from a recollection of the subject, or from a knowledge of the subject conveyed by the index, rather than from the exact title of the article, which may not always be entirely comprehensive; hence the articles are indexed under such leading words as seem most suggestive, going outside the title for a word, to this end, if it seem essential to clearness.

A glance at the index will give a good idea of the variety of subjects treated editorially and by those who have contributed to our columns. They are such subjects, it seems to us, as the practical man, whether engaged in using the tools of the craftsman, or in planning and designing machines and machinery, is interested in; such subjects as the manufacturer and those who superintend the processes of manufacture are concerned about; such subjects as those who buy and those who sell machinery may profitably give attention to. Our aim has been, in this respect, to prepare and to secure the preparation of articles that would interest every one in any way connected with the manufacture, sale or operation of machinery in the lines to which we give attention, and the verdict of our readers upon what we have done has been such as to encourage and to satisfy us. For this we are under obligations to those who have contributed to our columns—men occupying every position in the great manufacturing interests of the country, and those engaged in the equally important work of imparting instruction in technical schools.

We have no startling announcements to make for the year 1888. We prefer to let the years, as they go by, tell their own story, leaving the verdict to our readers. Certainly no thought of changing the policy or narrowing the field and scope of the paper has been entertained, and none will be. The AMERICAN MACHINIST will continue to appear under its present title, and with its familiar title page. As it has been conducted in the past, so it will be conducted in the future. At the conclusion of next year we shall leave our readers to judge of the year's work, just as, at this time, we submit the past year's work for their criticism. That judgment will be just; whether or not it will be as flattering to us as former judgments have been, will, we fully realize, depend upon our own efforts.

A Gloomy View of Modern Civilization.

In an address recently delivered in England by Professor Huxley, he takes the ground that modern industrial activity and competition is simply a warfare carried on under the forms of peace, and that the men or the nations who secured victory in this warfare defeated their opponents by starvation. In other words, that all the new discoveries in the arts and sciences, by which processes or products of manufacture are improved or rendered cheaper, and which are generally regarded as blessings to mankind, are, in reality, simply additional or improved weapons by which the individual, company, or nation who can control and make the best or exclusive use of such inventions or improvements, is enabled to more successfully carry on this warfare, and all the more easily and certainly inflict upon their competitors or opponents the penalty of defeat—starvation.

This address was delivered in support of a proposed institute in which it is proposed to offer to the youth of England the best possible facilities for obtaining technical training and education. The idea advanced by the learned professor was that, this condition of war being recognized, it was necessary for England to secure for herself the best possible weapons for waging that war, and that one of the most effective weapons was to be found in technical education.

There is much food for thought in such a declaration, coming from such a source, and it would be a great satisfaction if we could deny its truth; but can we? And if we cannot deny its truth, then it becomes pertinent to inquire if a progressive civilization, which carries with it such results, is worth what it costs, and whether or not it can continue to progress, if, by its progress, it inflicts such a penalty upon those who are unable to attain the victory.

England has recently been meeting reverses in this industrial warfare, and the penalty of hunger has been suffered by many of her working people. Suppose that, by means of the improved weapon which Professor Huxley speaks of, she regains her lost ground, will it not be at the expense of other industrial armies, composed of human beings, who have claims upon our sympathies?

Altogether it is a very gloomy view of the situation, but we have faith to believe that a better condition of things will be developed, and that civilization will eventually progress without the infliction of such a penalty upon those who may be surpassed in ingenuity and skill by their fellow man.

We have no theory to advocate to bring about this condition, but we think that, for the best interests of mankind, such a condition must be brought about, and that in some way it will be.

The boom for natural gas has already begun to fail in some localities, owing to the habit of raising the price to an extent hardly accounted for by percentage, as soon as its use is fairly established. In one instance of a concern using the gas for manufacturing purposes, the price was raised from $1,500 to $15,000 per year. The company went back to the use of coal. In another instance the inhabitants of a large village were, a great portion of them, constrained to discard their usual stoves for those arranged to burn gas, the gas being furnished them at a very reasonable rate. When it came time to renew the contracts the original price was multiplied by ten to form a new price. The moral of this is, don't put yourself in the power of a monopoly, that is, if you can help it, which is getting to be doubtful.

The New York *Herald* publishes a list of the savings bank failures in the State of New York from the year 1871 to 1879. According to this list twenty-nine savings banks failed during that time, involving deposits to the extent of $15,000,000. It is a bad record, and, as we have previously said, tends to discourage those who invest in such institutions. Of course depositors did not lose all their deposits, but they lost a good deal of money, and the moral effect of imperiling the whole is nearly as bad as if all were lost. If there is anything the State is called upon to do well, it is to look after the condition of institutions holding in trust the money of women and children, and those who work a lifetime to accumulate a few hundred dollars.

We are under obligations to those who, in response to a request, have sent us copies of constitution and by-laws of relief associations established in manufactories. These associations are usually very simple, consisting of an agreement on the part of the men to pay a small sum per month, or to submit to a small assessment, for the benefit of a sick member, or to a little larger one for the benefit of his family in case of his death. We believe them to be excellent in their way, and think that workmen in shops and factories generally would do well to consider the advisability of forming such associations. In some instances we notice that employers are generous in their gifts to create a fund.

Regarding an inquiry from a manufacturer as to the number of sanitary closets required in a manufacturing establishment, Messrs. Brown & Sharpe write us: "We have never given the subject very careful consideration, but are inclined to think that one closet to 25 men would be sufficient."

If we are to believe half the accounts we hear—and we see no reason to doubt them—those who buy steel or iron of foreign make will need to exercise a good deal of care. It appears that a regular business is done in Germany in fictitiously stamping such products.

Literary Notes.

STANDARDS OF LENGTH AND THEIR PRACTICAL APPLICATION. A résumé covering the methods employed for the production of Standard Gauges to insure uniformity and interchangeability in every department of manufacture. Including the reports of Prof. Wm. A. Rogers, the Committee on Standards and Gauges, American Society of Mechanical Engineers; the Committee of the Master Car Builders' Association; and including also the report of the special committee appointed by the Franklin Institute, April, 1864. Edited by George M. Bond, M. E. Published by The Pratt & Whitney Company, Hartford, Conn.

This is a work of undoubted value not only to engineers and manufacturers, but to mechanics as well. Professor Rogers' report alone contains a vast amount of information in relation to experiments made in investigation of the subject, and this information is such as to indicate to the practical man the infinite precaution required in such matters.

Two lectures by George M. Bond, before the Franklin Institute, one on Standards of Length and their subdivision, the other on Standards of Length as applied to Gauge Dimensions, which appear in the work, are also of remarkable interest, and cannot fail of being instructive.

At this time, when the interest in the subject of accurate measurement is so great, and the matter so important, this book will, we are sure, be received with much satisfaction by the mechanical world. It is a book of 180 large pages; we are not informed of the price at which it is sold.

STEAM BOILER EXPLOSIONS IN THEORY AND PRACTICE. By R. H. Thurston, M. A., Doc. Eng. John Wiley & Sons, New York. Price, $1.50.

There are in practice many engineers who never gave a thought to the latent energy for trouble stored up in a steam boiler. It will do every such engineer good to read the work, the title of which is given above. Professor Thurston has had exceptional facilities for investigating the cause of boiler explosions, and throughout this work there will be found matter of peculiar interest to practical men. Various examples of explosions are given, with the causes that lead to them; this cannot fail to be of importance to every one who is studying the subject. Causes that bring about boiler explosions, such as faulty construction, unequal temperatures and unequal expansion, etc., are very clearly dealt with.

In the brief space that we can give to the matter, it would be quite impossible to even indicate the points touched upon in this book, but we believe that no one who invests the small price at which it is sold, in securing it, will ever regret it. The book is well illustrated, and printed in clear type.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(532) H. C., New York, writes to say that we made a mistake in our answer to Question 451, in our issue of Nov. 12. It is evident from his remarks, however, that he has entirely misunderstood the answer, and that if he will read it over more carefully he will find it to be correct.

(533) J. L. H., Washington, N. J., writes: We run our boiler nights in the winter time, to keep the pipes in the building from freezing. The water pressure is sufficient to feed the boiler. We have a good injector not in use; would there be any saving in using this to feed the boiler instead of feeding by water pressure? *A.*—There would not be much, if any, saving in fuel. If the water enters the boiler through perforated pipe so as not to be brought in

contact with sheets till heated, then feeding by water pressure is all right; if not, it would be better to use the injector, so as to warm the water before it comes in contact with the sheets.

(534) J. E. H., Lynn, Mass., asks: Will you tell me if there is any objection to pumping the condensed water from a coil heater directly back into the boiler, not over ⅛ pint of cylinder oil going with the water, the boiler being 15 horse-power? The water used is soft, and forms no scale. *A.*—If you use mineral oil in the cylinder, blowing off occasionally, we should say you would have no trouble.

(535) C. L. C., Gardiner, Me., writes: I have been advised to use logwood and soda ash for removing scale from boilers, and have found it to work very well indeed. Will it injure the boiler? *A.*—The presumption is that it will not; still, there may be cases where its use would be inadvisable. It is always better to use such things under the advice of a competent inspector of steam boilers, or an engineer of extended experience, who can judge by the circumstances if injury is likely to result.

(536) E. W. R., Painesville, Ohio, asks: Will you please give me the theory of the water brake used on some Western railroads? *A.*—A small pipe is tapped into the boiler below the water line, and leads to the exhaust passages from the cylinder. A valve in this pipe is controlled by the engineer. In holding a train down the mountain he opens this valve more or less, putting the valve gear in reverse motion, and opening the cylinder cocks, using the water to resist the motion of the piston as much as he can with safety.

(537) H. S. C., Prescott, Ont., writes: Please give me the formulas for finding the weight necessary to be placed on the lever of a safety valve, the diameter of valve, length of lever, and fulcrum being known, to withstand any given steam pressure in a boiler.—*A.*—See AMERICAN MACHINIST, page 2, Dec. 6, 1884. 2. To determine the strain brought on the braces of a boiler with a given pressure of steam, the position and distance apart of braces being known. *A.*—See answer to Question 314, AMERICAN MACHINIST, July 23, 1887, also see answer to Question 505, Dec. 10, 1887.

(538) L. P. H., Montgomery, Ala., is running a pair of 10 x 20 Porter-Allen engines, doing heavy work, with great and sudden variations of load. He states that he has tried all kinds of Babbitt metal, with no success, and wishes to know how to make very hard Babbitt, or the best *A.*—We know of no better Babbitt than that for which we gave the formula in our issue of Oct. 22, 1887. We do not think you will find it advantageous to use harder Babbitt than this, but if you do so desire you may increase its hardness by putting in a greater proportion of the "hardening."

(539) D. R. W., Pawtucket, R. I., asks: Would I be liable to prosecution by making a model of a patented machine? *A.*—If you make a patented device to use or to sell you are liable to prosecution for infringement. You have a right to experiment with a patented device with a view to determine whether or not it will work according to specifications. If you want to build a model machine involving somebody's patent it would be no more than courteous to write him asking permission, which would undoubtedly be granted. There are patents still in force on the steam engine you name.

(540) W. C., Indianapolis, Ind., asks: When the valves of an engine are set how can I tell which way it will run? *A.*—Put the engine on either dead center; then you will find the steam valve just beginning to open the port. Then look at the eccentric and connections, and if you have any idea of mechanical appliances you can tell which way the crank must turn to continue to open the steam port; that is the way the engine will run. If you cannot tell without, then turn the engine in one direction or the other and you can observe. The main thing is to give a little thought to the subject.

(541) Studious, —— Minn., writes: To become proficient in the higher mathematics what studies shall I take up? I want what will be of greatest benefit to me as a machinist and engineer. In my leisure hours I have made considerable progress in algebra, geometry and trigonometry. *A.*—Pursue the studies in which you have already made progress, add to your studies that of drawing, analytical geometry, descriptive geometry, analytical mechanics, applied mechanics; also study other books relating to strength of material, engineering, and construction of machinery in general. As you advance, your own knowledge will indicate the books you should study.

(542) J. A. H., Boston, Mass., writes: 1. Is there any law in New York State which compels an employer to bind the apprentices he takes to learn a trade. *A.*—We do not know of any such law, and believe that there is none. 2. If a law of that kind should exist, has a young man any redress who has worked at a trade, and after the time has come when he should have learned it, he finds out that his employer has used means, or allowed his workmen to prevent him from learning, thereby preventing him from commanding or being worthy of proper wages. *A.*—You may enter into an agreement with your employer when you are about to commence your apprenticeship, and whether you can have any redress after you have found out that the employer did not treat you right depends on how the agreement is worded. Often, when an apprentice finds fault, it may be a delicate question to decide who is wrong, as the apprentice may not have the ability to learn. Our advice would be to enter an apprenticeship without any agreement, enter it honestly, look out for your employer's interest, and at all times work hard, be an honest man in every sense of the word, and if then you find that you are working for a mean person, tell him so, and quit.

(543) W. J. T., Bradford, Pa., writes: Please inform me what causes the cutting of valves and valve seats in slide valve engines. An engine 16" x 24" making 135 revolutions, with slide valves partly balanced, with four plates arranged to fit and bear against steam chest cover, slide valve has 200 square inches and balance plates 113 square inches, steam ports, 1" x 13"; bridge, 13-16"; exhaust port, 1¼" x 13", and ¾ lap, was put in a saw mill about a year ago and run about eight months, giving good results. During the summer months the mill was standing still, and on starting up this fall, the engine ran about two weeks, and afterwards could not keep up steam. Taking off the steam chest cover, we found that the valve and valve seat were cut about ¾ of an inch. Consequently the cylinder was brought to the shop for repairs. This time, instead of putting in a balanced valve we put in a plain slide valve. After the engine had run two days the valve and seat had worn as before, if anything, more so. This time we put in a false valve seat and new valve; since then we have not heard of any further trouble, and therefore we conclude that the engine is working well. I claim that the fault is in the boilers, because the boiler next to the engine has not a proper blow-off cock, and can only be blown off by taking off the check valve and blowing water back into the tank from which the boilers are supplied. I also claim that, with proper care and sight-feed lubricator, all this trouble might have been avoided. Now, what surprises me is, that in this part of Pennsylvania we can go to any of the surrounding mountains and count hundreds of engines from 12 to 20 horse-power, all kinds of make and style, but not one ever comes to the shop for repairs, such as our saw mill engine needed. Besides this saw mill engine we have had five others in the same shape, all wearing out from ½" to ¾", so that now we have to put in false valve seats and new valves in all engines. *A.*—There is no doubt but that the engines will give better satisfaction and run without repairs for a longer period of time in the charge of competent engineers, than engines running without the proper care. It is also very important that the boilers should be kept clean, otherwise dirt may get into the steam chest and wear the valve seats very quickly. But, according to your own statement, namely, that only in your engines the valve and valve seats wear out, and after false valve seats have been put in further trouble is avoided, we conclude that the metal in your cylinders is too soft.

(544) O. W., Detroit, Mich., writes: I am acquainted with persons intending to build a yacht in which I think the machinery is one of, if not the principal feature. Dimensions of the boat are: Length, 65 feet; beam, 11 feet; draught forward, 18 inches; aft, 36 inches. What criticisms have you to make on the following dimensions and construction of machinery? Boiler, 4 feet diameter, 6 feet long; number of flues, 50; diameter of flues, 1¾ or 2 inches. Scotch or flat bottom, return flue, other parts being in accord with the best practice. Pressure, 100 pounds; fuel, hard coal. The engine to be a steeple compound, 7" and —12" stroke, surface condensing, riding cut-off on D slide valve for high pressure cylinder, and double ported for low-pressure cylinder. Diameter of wheel 4 feet, and pitch 6 feet. *A.*—It is true that the machinery comprises one of the principal features of a steam yacht, but it is equally true that the lines and displacement are other principal features; the speed, also, is an important item. Since you have not given any data relating to the latter items it is impossible for us to give such criticisms as you require. But we will say this, that we consider the boiler by far too small; as to the type of boiler, we would prefer the locomotive type with return flues, because these boilers will require less space than the Scotch boilers. The flues should not be less than 2 inches in diameter, and the total grate surface should be about 25 square feet; the heating surface about 700 square feet. A compound engine 7" and 13" x 12" stroke may do the work, but this will depend on the displacement and the speed. 2. It will be necessary to use a blower. Do you advise one driven by pulley on shaft or live steam in stack? *A.*—We should advise a blower driven by an independent engine. 3. In place of a steeple engine would not a fore and aft engine be preferable? If so what reasons would you advance outside of convenience of starting? *A.*—We prefer a fore and aft engine because it will bring the center of gravity lower. 4. Do you advise piston valves? If so or not, why? *A.*—We are not in favor of piston valves, because we have not yet found any which will keep tight for a considerable length of time. 5. What will a riding cut-off valve save in conditions mentioned? *A.*—With a riding cut-off you can readily change the point of cut-off, and thereby regulate the power of the engine and promote economy of fuel. 6. Would not cylinders of equal area but of less stroke be more advisable? *A.*—We have not sufficient data to answer the question. To build a yacht having the dimensions given by you will require considerable outlay, and it seems to us that to build such a yacht, without a competent engineer to design it, may prove to be a very costly experiment. To design a yacht of this kind requires considerable experience and a great amount of time; our advice to you is, if you wish to build a yacht for the minimum amount of money, and make it a success, by all means employ an engineer who thoroughly understands his business.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and patternmaking. Anderson Machine Works, Peekskill, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

For Catalogue of 2d hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N.Y.

Agencies wanted for mech. appliances or pat. processes. Müller & Sieghortner, r'm 10, 319 B'way, N. Y.

Buy the Excel. Upright Drill; sizes, 20", 25", 28", 32", 36" swing. Currier & Snyder. Worcester, Mass.

Castings for 2½"x 3" and 3½"x 4" vertical engines. Send for circular. F. W. Adams, Watertown, N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Berryman Patent Feed Water Heater and Purifier, and the Economic Boiler Feed Pump Benj. F. Kelley, 91 Liberty st., New York.

Ten 16 in. Engine Lathes, ten 18 in. Eng. Lathes, ten 14 in. Eng. Lathes, ten 15 in. Engine Lathes. Nicholson & Waterman, Providence, R. I.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Working drawings of mach'ry and factory plants, buildings included. Indicator tests of steam and gas engines. T. H. Müller, eng., 319 B'way, r'm 10, N. Y.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps. Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators Curtis Return Trap Curtis Damper Regulator. See Dec. 10, p 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

$1 for 12 delivered as sample. Brown's machinery wipes do not ignite by spontaneous combustion, and are cheaper and better than waste. Geo. S. Brown, 2290 Washington st., Boston, Mass.

For practical working drawings of machinery call on A. K. Mansfield & Co., 280 Broadway, N. Y. Lifelong mechanics; one formerly R. R. superintendent motive power. Important references.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue E. & F. N. Spon, 35 Murray st., N. Y

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

MANUFACTURES

M. F. Bigney, New Orleans, is interested in building a large cotton mill.

L. J. Ham, of Carlisle, Ky., will build a carriage factory at Talladega, Ala.

W. B. Berry is interested in a company that will build a cotton mill at Newnan, Ga.

The Cincinnati Southern Railroad Company has decided to build shops at Somerset, Ky.

The Houston (Texas) Car Wheel Foundry Company has been chartered; capital stock, $50,000.

G. H. Cleveland, Camden, Me., will at once rebuild his shirt factory, recently destroyed by fire.

The Bloomfield Water Power Company, of Athens, Ga., will build a cotton factory at Barnett Shoals.

Beaudry & Co.'s duplex press, illustrated in our issue of Dec. 3, was awarded the special medal at the fair of the American Institute.

Robert Kerr, of Paisley, Scotland, has bought twelve acres of land in Fall River, Mass., on which to build a thread mill, to employ 700 workmen.

A stock company is being formed at Bessemer, Ala. to erect a sash, door and blind factory. The Bessemer Land and Improvement Company are interested.

The outlook for work at Roach's shipyard, at Chester, Pa., has not been brighter for years. It is said that the force at work there must soon be doubled.

A company has been organized at Northampton, Mass., to be known as the Martin and Hill Cash Carrier Company. Shops will be erected at Florence, Mass.

The Consolidated Hand Method Lasting Machine Company, Boston, Mass., will purchase tools with which to fit up a shop for the manufacture of their lasting machines.

Contracts have been let by the Athens Mining and Manufacturing Company for the erection of water-works; also a cotton mill and furniture factory, at Athens, Tenn.

D. Saunders' Sons, Yonkers, N. Y., have recently shipped one of their No. 8 machines, for cutting off and threading pipe from 4" to 12" diameter, to Knight & Jillson, Indianapolis, Ind.

A. C. Brown, of Oldtown, Me., and Henry Rolfe, of Orono, are amongst those who have purchased the Gilman mills. They propose to erect either a pulp or paper mill, or both.

The Middlesex Electric Light Company, of Lowell, Mass., are building an addition to their station, and will increase their plant materially. Toward this end they have ordered a Wainwright feed-water heater of 500 horse-power capacity.

The Cincinnati, Indianapolis, St. Louis and Chicago road has decided to erect large shops at Indianapolis, Ind., which will employ 450 men. The plans have been prepared, forty acres of ground purchased, and work will begin in the spring.

The Pierce Well Excavator Company, Long Island City, New York, has issued a new and enlarged catalogue of well drilling and boring machinery, and tools and machines for prospecting and developing mines, etc. The catalogue is very fully illustrated.

The Sulphur Springs (Tex.) Ice and Industry Company has organized with a capital of $30,000, making application to the Secretary of State for a charter. This company is for the manufacture of ice and to establish electric lights throughout the city. The company contemplates having everything in running order by March next.

We recently noticed that the shops of Warder, Bushnell & Glessner Co., at Springfield, Ohio, had adopted electric lighting, and gave the number of lights as 600. This number was too low; the number is nearly 1,000. Two systems of lighting are employed, the Mather-Perkins incandescent system and the Waterhouse arc lamp system.

Curtis & Curtis have succeeded to the business of the firm of Forbes & Curtis, Bridgeport, Conn., manufacturers of the well-known Forbes Patent die stock, pipe cutting and threading machines, etc. They write us that they are continually pressed with orders, and they contemplate enlarging their factory and facilities as soon as the spring opens, so as to more than double their output.

The *Richmond Whig* says: That the foundry business of Richmond is on the rapid increase, is illustrated by the fact that the Tredegar Company has put out from their four foundries for the past season over one hundred thousand pounds of castings per day. They have just completed an order for 700 freight cars, and are working between sixteen and eighteen hundred men in their various departments.

H. D. Penney, New Gloucester, Maine, writes us: "My business for the year just closing has been quite satisfactory, and fully up to my expectations. During the early part of the year, it being my first, I was not rushed with business. I have been engaged upon light work mostly. During 1888 I shall bring out a new sectional upright boiler for small power. In the spring I shall enlarge my capacity by building a new shop."

It is anticipated in Bath, Me., says the Bath *Times*, that Congressman Dingley will endeavor to get a contract for a government steel cruiser to be built there, and there is confidence that he will succeed. It is said that, if he succeeds, an iron shipbuilding plant will at once be established. A steel cruiser to build means $2,000,000, and good mathematicians figure this up as yielding 10 per cent. interest on the amount of capital required to furnish and equip the plant.

New water-works, or the enlargement of old ones are contemplated at El Paso, Tex.; Passadena, Cal.; Marion, Iowa; Sanford, Fla.; Fairchance, Pa.; Pine Bluff, Ark.; North Berwick, Me.; Little Chute, Wis.; Concordia, Kan.; Reading, Pa.; Fulton, Mo.; Dover, N. H.; Brookline, Mass.; Des Moines, Iowa; Centralia, Ill.; Sandusky, Ohio; Pawtucket, R. I.; Harrington, Kan.; Waxahachie, Tex.; Glendale, Ohio; Weathersford, Tex.; Williamstown, N. Y. Kentland, Ind.; Dayton, Ky.; Winchendon, Mass.; Orono, Me.; Florence, Wis.

Machinists' Supplies and Iron.

New York, Dec. 15, 1887.

Iron—American Pig—The condition of the market is much the same as given in our last report. The demand is of a hand-to-mouth character, and not much disposition is shown to enter into operations involving the future. We quote Standard Lehigh brands firm at $21 to $21.50 for No. 1 X Foundry, but outside brands are obtainable at $20 to $20.50; No. 2 X rules at $19 to $19.50 for Standard brands. Other brands $18 to $18.50, and Grey Forge from $16 to $17.

Scotch Pig—There is great speculative activity in Glasgow, and still higher prices are quoted there, the market here being firmer in consequence. But very little fresh business has been done here, as buyers resist the advance demanded by sellers. We quote Coltness, $22 to $22.25; Glengarnock, $19.75 to $20.25; Gartsherrie, $21 to $21.20; Summeriee, $21.25 to $21.50; Eglinton, $19 to $19.25; Langloan, $20 to $20.50; Dalmellington, $20 to $20.50, and Clyde, $20 to $20.50.

Lead—The market has ruled dull, with less tendency to speculative operations, and only occasional sales to dealers and consumers. Values are uncertain, bids ranging from 4.77½ to 4.80 cents, while sellers hold at 5 to 5.10, according to delivery.

Antimony—Regulus is firm at a still further advance in prices. The small available supply and high prices ruling in England enabling holders to obtain about what they ask. Hallett's is held at 11 cents, and Cookson's at 12 cents.

Copper—Prices have steadily advanced, as a result of speculative operations in this country and England. The reports of the cave-in at the Calumet and Hecla mine has had the effect of stimulating speculation. Present prices are 17¼c. for spot, 17.65c. for December; 17.80c. for January, and 18c. for March.

Spelter—The market has ruled quiet but firm, and smelters report that they have sold ahead all their surplus productions for this and next month. Ordinary brands rule at 5.30 to 5.35 cents, and Glendale at 5⅝ to 5.70 cents; Silesian is quoted at 5.90 to 6 cents. We quote Domestic 5¼ to 5⅝ cents; Refined, 6¼ to 6½, and Silesian 6 to 6¼.

Tin—There has been very little change in the market. We quote Straits and Malacca 36½ to 37 cents, cash.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to sell planes, see page 11.

Wanted—By a practical die-cutter and toolmaker, situation; used to taking charge of help. Address W. W. O., Am. Machinist.

Wanted—Situation as foreman boilermaker by a man of experience on all kinds of boiler work; good references; age 35. Eclipse, Am. Machinist.

Mechanical engineer and designer, competent as supt., head draftsman, or engineer, desires to change; Corliss engine expert. Indicator, Am. Machinist.

Wanted—A situation by first-cass machinist; work on lathe, vise and planer; capable of handling men. J. A. D., Am. Machinist.

Wanted—A foreman for a foundry job shop; about 40 moulders employed. Address, stating age, references and salary expected, Foundry, Box 3143, Boston, Mass.

Wanted—A good machinery moulder; one capable of taking charge of a small shop where considerable heavy work is done. Address McEwen Bros. & Co., Limited, Ridgway, Pa.

Technical school graduate and gen'l mach., age 30; also several years' designing, building and improving special mach'y, wishes responsible position without much drafting. A1 ref. Practical, Am. Machinist.

Wanted—Good machinist to get up machinery and labor-saving appliances in connection with the production of small springs from cold coiled wire. Address, stating exp., K. W. B., Am. Machinist.

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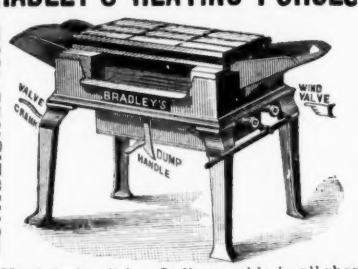

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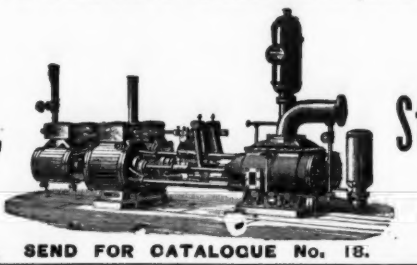

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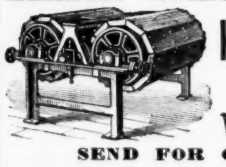

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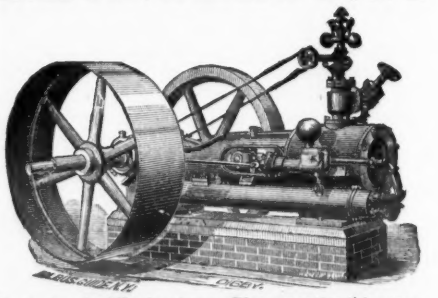

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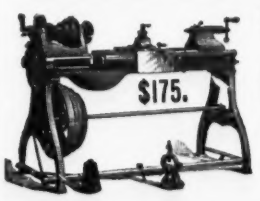

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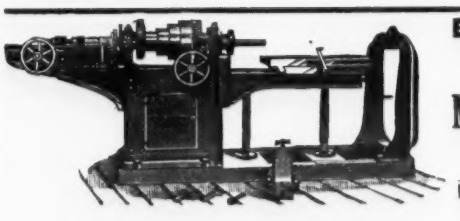

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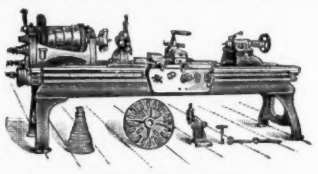

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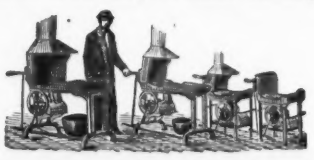

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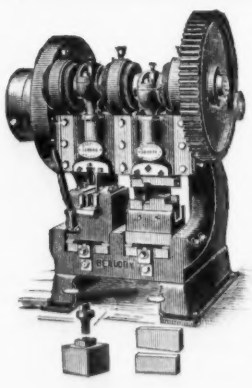

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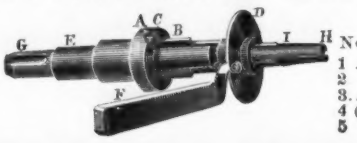

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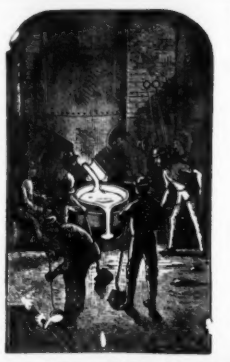

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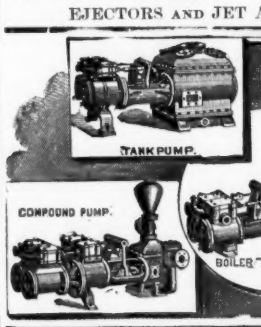

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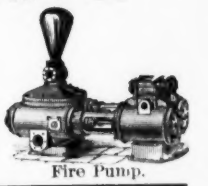

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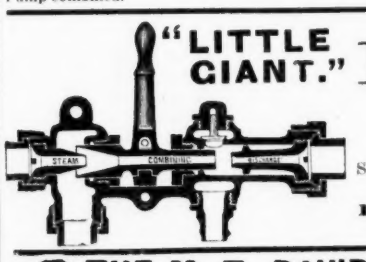

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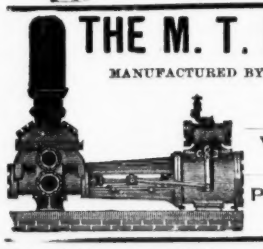

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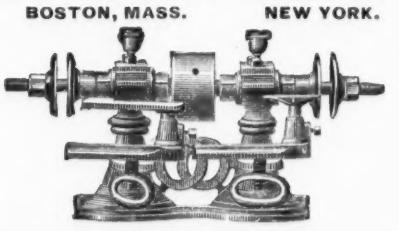

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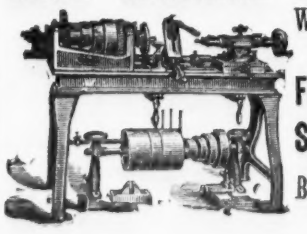

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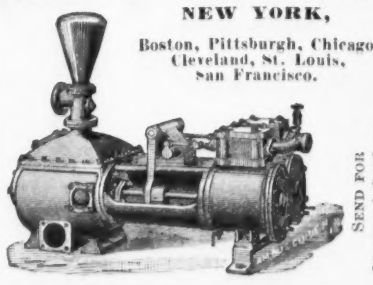

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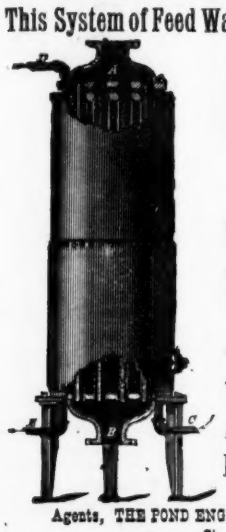

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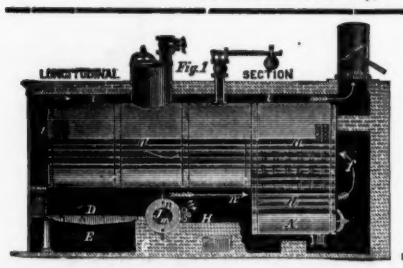

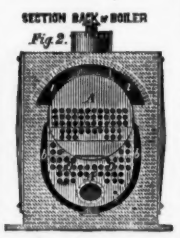

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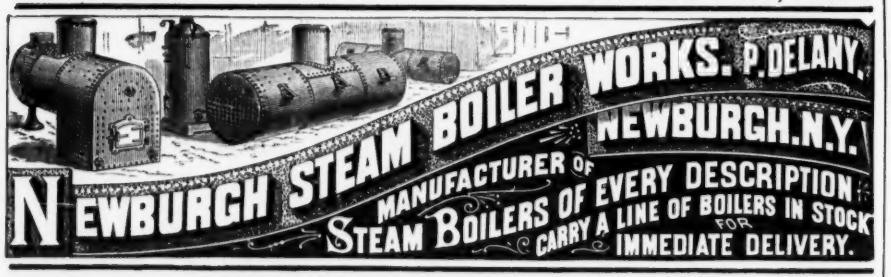

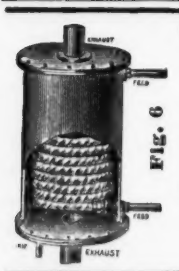

Fig. 6

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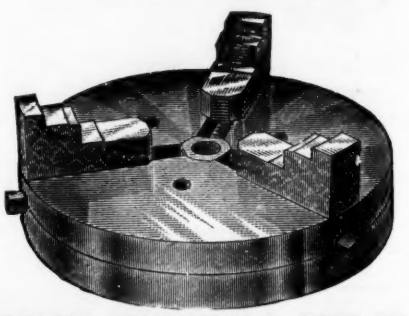

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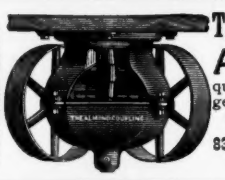

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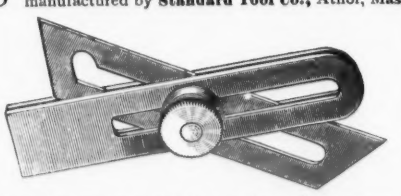

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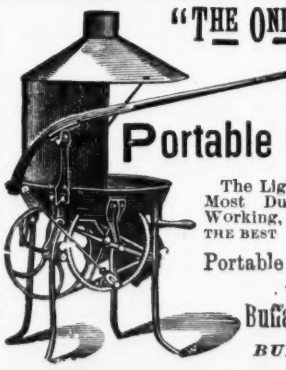

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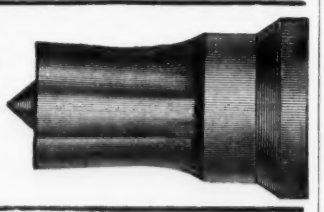

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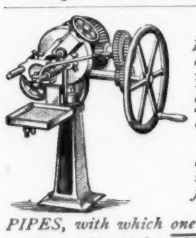

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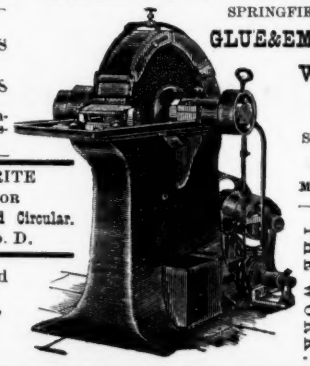

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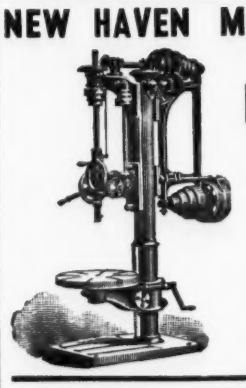

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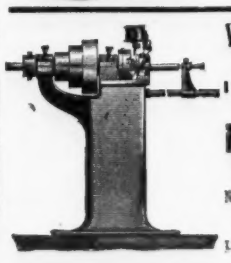

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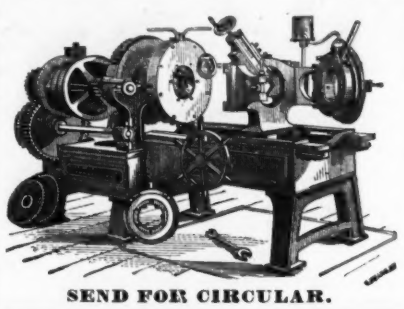

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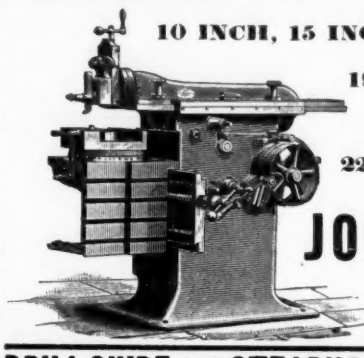

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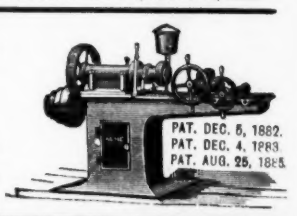

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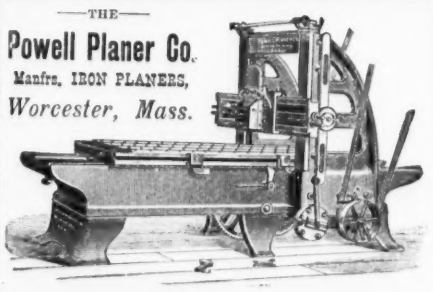

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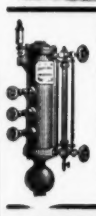

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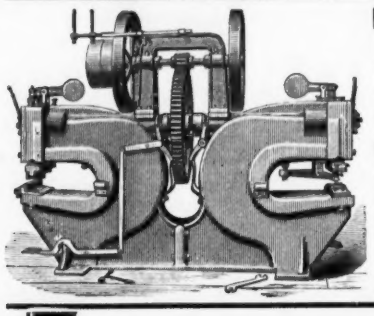

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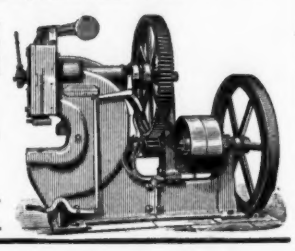

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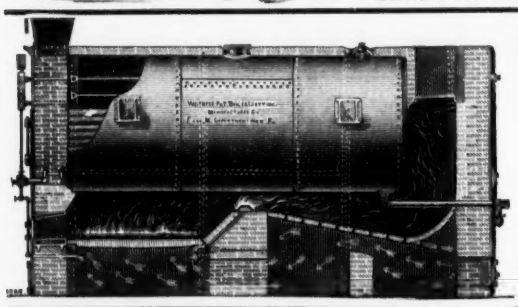

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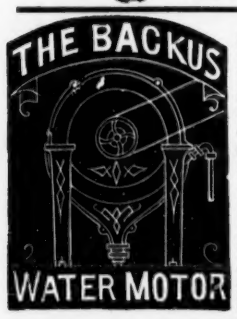

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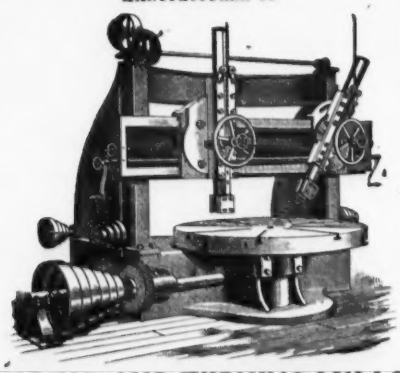

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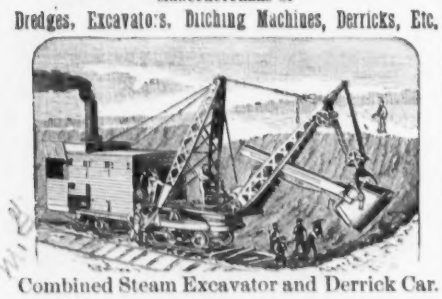

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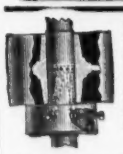

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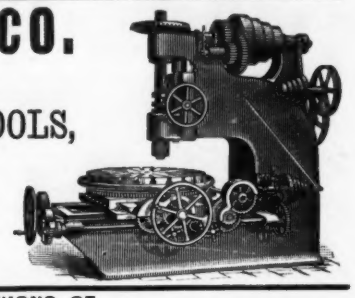

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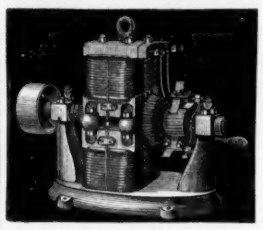

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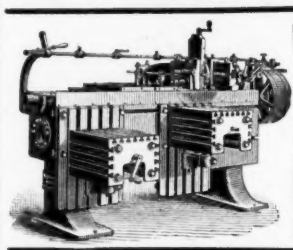

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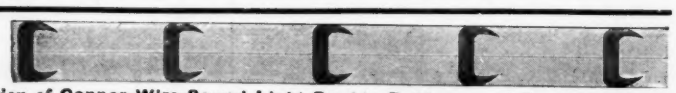

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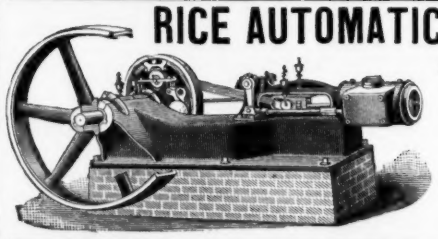

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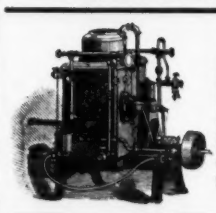

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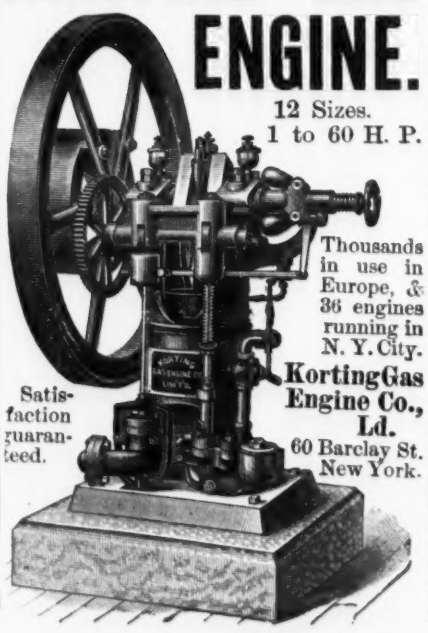

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